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C1 General

C1.1.1 Definition

Static operations are activities contained within a fixed worksite.

Activities within a moving worksite are subject to the rules and guidelines in section D Mobile operations.

C1.1.2 Closure length

The length of any closure must be the minimum required to undertake the activity.

Closures should generally not be longer than 1km.

C1.1.3 Number of contractors at a worksite

A worksite must be under the control of only one contractor at a time.

If another contractor wishes to ~~work~~ undertake activity on the same section of road they must request permission from the current worksite contractor, the engineer and/or the traffic management coordinator (TMC), or other road controlling authority (RCA) authorised person.

The TMC/engineer, or any other RCA-authorised person, must approve any amendment to the existing traffic management plan (TMP) if it has to be adjusted to accommodate another contractor's activity.

C1.1.4 Inclement weather conditions

When adverse weather conditions affect visibility to the signs and/or the worksite so that sign visibility distance to the first sign cannot be achieved, it may be necessary to cease ~~work~~ the activity and clear the worksite of all personnel in the interests of safety.

In exceptional cases it may also be necessary to clear the carriageway of all obstructions caused by the works, if this can be done safely. A decision on the need to clear the carriageway should be based on consideration of all prevailing circumstances, including:

- the nature of the works
- traffic volumes, and
- weather conditions.

C2 Worksite layout

C2.1 Introduction

C2.1.1 General

For level low volume (LV) and level 1 roads the worksite layout is based on the permanent speed limit or RCA-designated operating speed.

For levels 2 and 3 temporary traffic management (TTM) the layout of the approach signing, the initial taper(s) and any associated worksite activity must be based on the permanent speed limit. From the end of the initial taper the temporary speed limit (TSL) may be used for the layout of any subsequent tapers and the remainder of the worksite.

C2.1.2 Sign visibility distance (A)

The uninterrupted sight distance from an approaching road user to the first advance warning sign is defined as the sign visibility distance, A.

The higher the permanent speed limit, the greater the sign visibility distance required.

Sign visibility distances are given in the layout distance tables for levels LV, 1, 2 and 3.

C2.1.3 Warning distance (B)

The distance between the first advance warning sign and the start of the taper, or the start of the longitudinal safety zone if no taper is required (refer to subsection C6.2.2 Longitudinal (lead in) safety zones), is defined as the warning distance, B.

The warning distance is normally achieved by locating signs at the appropriate sign spacing. Where this cannot be achieved the sign spacing distances will need to be increased.

The warning distance has only been shown on drawings where the cumulative sum of sign spacing distances on an approach to a closure is less than, or equal to, the minimum warning distance required.

Warning distances are given in the layout distance tables for levels LV, level 1 and level 2.

C2.1.4 Sign spacing distance (C)

The sign spacing distance, C, is defined as the distance between two signs. Temporary warning and regulatory speed signs are required to be located at sign spacing distances to allow the road user to read, understand and comply with the sign's message.

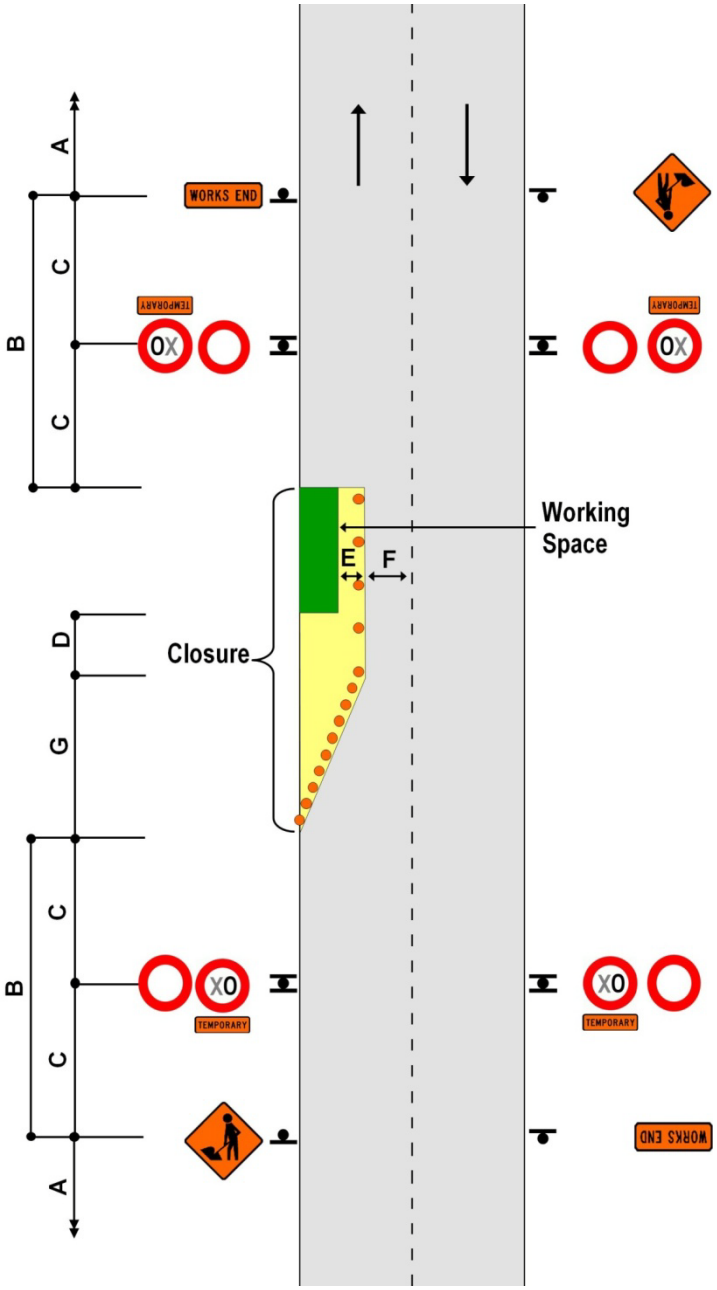
Signs that have a supplementary plate displaying a distance to a taper must be placed that specific distance in advance of the start of the taper or in advance of the longitudinal safety zone when no taper is required. If required, extend sign spacing to achieve minimum warning distance.

Where the cumulative sum of sign spacing distances on an approach to a worksite is less than the minimum warning distance required, the sign spacing will need to be increased such that the warning distance is achieved.

Sign spacing distances are given in the layout distance tables for levels LV, 1, 2 and 3.

C2.2 Explanation of dimensions in worksite layout distances tables

	Dimensions	Refer to
A	Sign visibility distance	C2 Worksite layout
B	Warning distance	C2 Worksite layout
C	Sign spacing	C2 Worksite layout
D	Longitudinal safety zone	C6.2.2 Longitudinal (lead in) safety zones **Note:** Apart from approved TTM equipment, this space must be maintained as a completely clear zone.
E	Lateral safety zone	C6.2.3 Lateral safety zones **Note:** Apart from approved TTM equipment, this space must be maintained as a completely clear zone.
F	Lane width	C2 Worksite layout
G	Taper length	**Note:** Apart from approved TTM equipment, this space must be maintained as a completely clear zone.



Working space – The area set aside for work.

Closure – The area of carriageway which road users are excluded from (eg the taper, longitudinal and lateral safety zones and any end taper).

C2.3 Level LV worksite layout distances

Permanent speed limit or RCA-designated operating speed (km/h)		≤50	60	70	80	90	100
Traffic signs							
A	Sign visibility distance (m)	50	60	70	80	90	100
B	Warning distance (m)	50 or 30*	80	105	120	135	150
C	Sign spacing (m)	25 or 15*	40	50	60	70	75
Safety zones							
D	Longitudinal (m)	0	0	0	0	0	0
E	Lateral (m)+ *+ (Optional for LV roads)*	1	1	1	1	1	1
Tapers							
G	Taper length (m)#	25	30	35	40	45	50
Delineation devices							
Cone spacing in taper (m)		2.5	2.5	5	5	5	5
Cone spacing: working space (m)		10	10	20	20	20	20

* The smaller minimum distance (dimensions B and C) can be applied to accommodate roading constraints.

+ On LV roads, the lateral safety zone may be reduced or eliminated in order to retain a single lane width. Positive traffic control and an appropriate TSL are to be used.

Where there are road environment constraints (including intersections and commercial accesses), a 10m taper with cones at 1m centres may be used for speeds 50km/h and under. This does not apply on state highways or where portable traffic signals, manual traffic controller (stop/go) or priority give way, are used.

On all roads tapers may be reduced to 30m where portable traffic signals, manual traffic controller (stop/go) or priority give way, are employed.

Lane widths									
(km/h)		30	40	50	60	70	80	90	100
F	Lane width (m)	2.75	2.75	3.0	3.0	3.25	3.25	3.5	3.5

Except for delineation device spacings, which are maximum values, the distances specified in the above tables are minimum values.

LV/low-risk roads

Working on roads designated as LV/low risk (less than 250 vehicles per day (vpd) - less than 20 vehicles per hour), with clear sight distance to the operation and an operating speed of less than 65km/h:

- Use an appropriate advance warning sign (static installation) and amber flashing beacon on working vehicle when ~~working~~ on the shoulder.
- Consider stop/go or give way control of traffic when activity encroaches onto lane.

If the above requirements cannot be achieved, the operation must be modified to comply with the requirements of a higher risk rating.

C2.4 Level 1 worksite layout distances

Permanent speed limit or RCA-designated operating speed (km/h)		≤50	60	70	80	90	100
Traffic signs							
A	Sign visibility distance (m)	50	60	70	80	90	100
B	Warning distance (m)	30 or 50*	80	105	120	135	150
C	Sign spacing (m)	15 or 25*	40	50	60	70	75
Safety zones							
D	Longitudinal (m)+ *+(Not required on LV roads)*	5 or 10*	15	30	45	55	60
E	Lateral (m)+ *+(Optional on LV roads)*	1	1	1	1	1	1
Tapers							
G	Taper length (m)#	30	50	70	80	90	100
G	**LV roads** taper length (m)#	25	30	35	40	45	50
K	Distance between tapers (m)	40	50	70	80	90	100
Delineation devices							
Cone spacing in taper (m)		2.5	2.5	5	5	5	5
Cone spacing: Working space (m)##		5	5	10	10	10	10

* Larger minimum distances apply where there is more than one lane each way and on all state highways.

+ On LV roads the longitudinal and lateral safety zones may be reduced, or eliminated, in order to retain a single lane width. Positive traffic control and an appropriate TSL are to be used.

Where there are road environment constraints (including intersections and commercial accesses) a 10m taper with cones at 1m centres may be used for speeds 50km/h and under. This does not apply on state highways or where portable traffic signals, manual traffic controller (stop/go) or priority give way are used. On all roads tapers may be reduced to 30m where portable traffic signals, manual traffic controller (stop/go) or priority give way are employed.

LV roads: double the cone spacing alongside working space (eg 5 = 10, 10 = 20).

Lane widths									
(km/h)		30	40	50	60	70	80	90	100
F	Lane width (m)	2.75	2.75	3.0	3.0	3.25	3.25	3.5	3.5

Except for delineation device spacings, which are maximum values, the distances specified in the above tables are minimum values.

LV/low risk roads

Working on roads designated as LV/low-risk roads (less than 250vpd - less than 20 vehicles per hour), with clear sight distance to the operation and an operating speed of less than 65km/h:

- Use an appropriate advance warning sign (static installation) and amber flashing beacon(s) on working vehicle when ~~working~~ on the shoulder.
- Consider stop/go or give way control of traffic when activity encroaches onto lane.

If the above requirements cannot be achieved, the operation must be modified to comply with the requirements of a higher risk rating.

C2.5 Level 2 worksite layout distances

Permanent/TSL (km/h)		≤50	60	70	80	90/100
Traffic signs						
A	Sign visibility distance (m)	60/50+	70/60+	80	100	120
B	Warning distance (m)	100/75+	120/90+	140	160	200
C	Sign spacing (m)	50/35+	60/45+	70	80	100
Safety zones						
D	Longitudinal (m)*	15	20	30	45	60
E	Lateral (m)					
	1. Behind cones	1	1	1	1	1
	2. Behind concrete barrier	0.5	0.5	0.5	0.5	0.5
	3. Behind other barriers	As recommended by manufacturers				
Tapers						
H	Initial taper length per lane**	90/50+	100/60+	120	150	180
I	Subsequent taper length per lane	50	60	70	80	100
K	Minimum distance between tapers	50	60	70	80	100
Delineation devices						
Spacing	All tapers	2.5	2.5	2.5	2.5	2.5
	Approaches, between tapers and around the working space	5	5	10	10	10
	At merge and diverge points for ramps and slip lanes, intersecting road entry and exit points, and worksite access points	2.5m for 10m either side of a change in alignment		2.5m for 20m either side of a change in alignment		

* A longitudinal safety zone is not required when a barrier completely protects the approach end of the worksite.

** Taper length is based on a single lane shift of 3.5m.

\+ The longer distance is the desirable distance, the shorter distance is the minimum distance required. The longer distances must be used wherever possible. The shorter distances may only be used where there are road environment constraints.

Lane widths									
(km/h)		30	40	50	60	70	80	90	100
F	Lane width (m)	2.75	2.75	3.0	3.0	3.25	3.25	3.5	3.5

Except for delineation device spacings, which are maximum values, the distances specified in the above tables are minimum values.

Approach signage, the initial taper and longitudinal safety zone must be based on the permanent speed limit. The layout of the remainder of the worksite, including any subsequent tapers, is based on the TSL.

C2.6 Level 3 worksite layout distances

Permanent/TSL (km/h)		♦80	100
Traffic signs			
A	Sign visibility distance (m)	100	120
C ❖	Sign spacing (m) - **Desirable**	160	200
	Sign spacing (m) - **Minimum**	80	100
Safety zones			
D	Longitudinal (m)*	45	60
E	Lateral (m)		
	1. Behind cones etc	1	1
	2. Behind concrete barrier	0.5	0.5
	3. Behind other barriers	As recommended by manufacturers	
Tapers			
H	Initial taper length per lane**	150	180
I	Subsequent taper length per lane***	80	100
K	Minimum distance between tapers	80	100
Delineation devices			
Spacing	All tapers	2.5	2.5
	Approaches, between tapers and around the working space	10	10
	At merge and diverge points for ramps and slip lanes, intersecting road entry and exit points, and worksite access points	2.5m for 20m either side of a change in alignment	

♦ For temporary speeds less than 80km/h use the C2.5 Level 2 worksite layout distances table.

❖ The desirable sign spacing distance must be used wherever possible. The minimum sign spacing distance may only be used where there are road environment constraints.
Where only one sign is erected in advance of the start of a cone taper the distance from the sign to the start of the taper must be 2xC.

* A longitudinal safety zone is not required when a barrier completely protects the approach end of the worksite.

** Taper length is based on a single lane shift of 3.5m.

*** Only applicable where the taper is a sufficient distance from temporary speed restriction for motorists to have slowed down to the temporary speed.

Lane widths									
(km/h)		30	40	50	60	70	80	90	100
F	Lane width (m)	2.75	2.75	3.0	3.0	3.25	3.25	3.5	3.5

General

Except for delineation device spacings, which are maximum values, the distances specified in the above table are minimum values. Approach signage and the initial taper must be based on the permanent speed limit. Any subsequent tapers, and the remainder of the worksite, are based on the applicable permanent or TSL.

C2.7 Lane widths

The temporary lane width is a function of the speed limit applied at a worksite.

The temporary lane widths for all levels of road for TTM are:

~~Permanent/TSL(km/h)~~		~~30~~	~~50~~	~~60~~	~~70~~	~~80~~	~~100~~
~~F~~	~~Lane width (m)~~	~~2.75~~	~~3.0~~	~~3.0~~	~~3.25~~	~~3.25~~	~~3.5~~

Permanent/TSL(km/h)		30	40	50	60	70	80	90	100
F	Lane width (m)	2.75	2.75	3.0	3.0	3.25	3.25	3.5	3.5

Temporary lane widths are measured as the available clear distance between delineation devices.

Temporary lane widths must not exceed 4m.

If the ~~work~~ activity does not affect the traffic lane these tables need not be applied.

C2.7.1 Heavy vehicles

Worksites with a high proportion of heavy vehicles may require lane widths greater than the values given in the table above.

C3 Signs and worksite zones

C3.1 Introduction

C3.1.1 General

All TTM signs must meet the design requirements in section B1 Signs.

C3.2 Worksite zones

C3.2.1 Three worksite zones

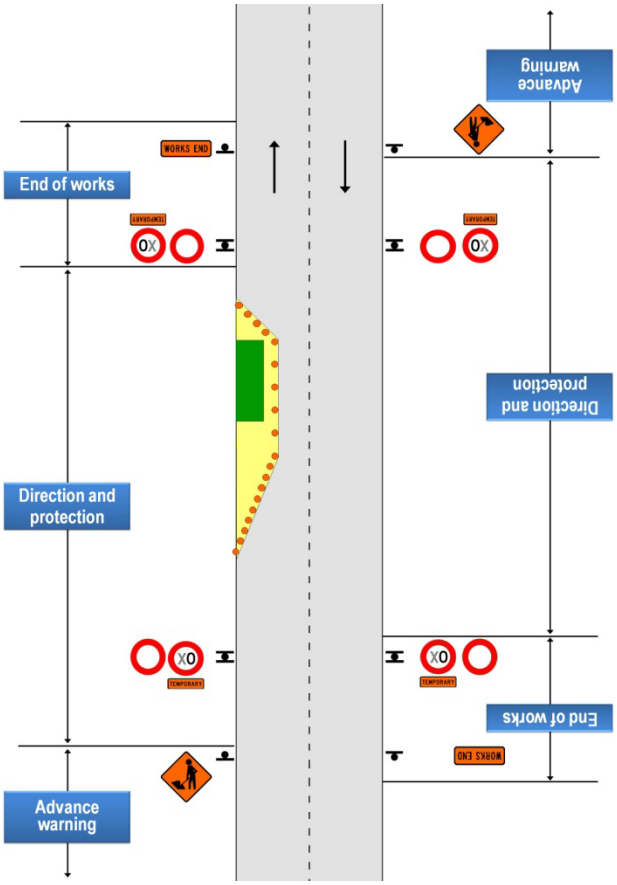
A standard worksite is divided into three distinct, but interrelated, zones. These are:

- advance warning
- direction and protection, and
- end of works.

C3.2.2 Signs in worksite zones

TTM signs provide the road user with information on:

Advance warning	The presence of the worksite and the type of hazard.
Direction and protection	The route they are required to travel to negotiate the worksite safely. The areas of the road which may and may not be used. The start and end of the TSL for the worksite.
End of works	The end of the hazard created by the worksite and the return of normal road operating conditions.



C3.2.3 Advance warning zone - signs

Advance warning signs **alert road users** to a hazard or activity on, or near, the road.

The signs indicate the nature of the hazard or activity. The signs must be placed at specific distances from the hazard to give road users sufficient time to slow down or to change their direction of travel.

Advance warning signs are required where the normal operating conditions of the road are changed due to the nature of the ~~work~~activity. Advance warning signs are required for traffic travelling in ~~both~~ all directions for all activities ~~associated with work~~ on the carriageway, shoulder and footpath.

When the ~~work~~ activity and associated safety zones are outside the edgeline and not on a sealed shoulder or footpath, advance warning signs are required in only one direction. For example, a power line maintenance activity outside the edgeline on a grass shoulder only requires advance warning signs in the direction of travel affected.

For level LV and level 1 roads a reduced level of advance warning is acceptable where:

- work does not affect a live traffic lane
- work is completed during daytime hours
- the posted speed limit is 50km/h or less.

This may be a line of cones along the extent of the ~~work~~ activity beside the live lane. In such situations the working space and any associated safety zone must not encroach into the temporary lane width.

Advance warning signs, and their appropriate use, are described in subsection B1.4.1 Advance warning.

C3.2.4 Direction and protection zone - signs

The direction and protection signs advise road users that the normal traffic lanes are not available and that they are required to change lanes, or that manual traffic controllers (MTC) or portable traffic signals are operating.

A limited number of regulatory signs may also be used.

Direction and protection signs, and their appropriate use, are described in subsection B1.4.2 Direction and protection.

C3.2.5 End of works zone - signs

End of works signs advise road users that the worksite or temporary hazard has been passed. The signs further advise that the condition of the road and the speed limit are returned to normal operating conditions.

The end of works signs are placed as follows:

If a TSL has been in place the speed limit must be reinstated to the permanent speed limit.

Road users are also provided with any advisory information connected with the worksite.

If the advance warning is provided by a T1 (TW-1) type road works sign then the end of works sign is the TG2 (TW-16) Works End sign.

On two-way two-lane roads the TG2 (TW-16) Works End sign is erected on its own stand opposite the first advance warning sign for a road works worksite.

The TG2 (TW-16) Works End sign must be displayed on the left-hand side.

Where the first advance warning sign is installed on both sides of the road, the TG2 (TW-16) Works End sign may be placed on the back of each advance warning sign.

A TG31 (TW-17) Thank You sign may be erected immediately below the TG2 (TW-16) sign, when the additional message is considered desirable. The Land Transport Rule: Traffic Control Devices 2004 (TCD rule), part 3, schedule 1, number W7-7.1 allows a combined TG2/TG31 (TW-16/TW-17) plate. This may be used in the dimensions given in the rule.

If the advance warning is anything other than a T1A/B (TW-1/TW-1B) then the end of works sign is the TG31 (TW-17) Thank You sign.

The TG31 (TW-17) Thank You sign is erected on its own stand opposite the first advance warning sign for the worksite.

If advance warning signs are located on both sides of the road a TG31 (TW-17) Thank You sign may be attached to the back of each sign.

End of works signs, and their use, is described in subsection B1.4.3 End of works.

C3.3 Position of signs

C3.3.1 Location of temporary warning and TSL signs

On **all roads** temporary warning and regulatory signs are required to be located on the left-hand side of the road for the direction of travel. On level 2 and level 3 roads, and multilane level 1 roads additional temporary warning and speed limit signs must be located on the right-hand side of the road.

Except for LV roads and other roads with an annual average daily traffic (AADT) of less than 500vpd, TSL signs **must** be gated (a TSL sign on each side of the road).

On **two-way two-lane roads** repeater TSLs are required at no more than 400m intervals on the left-hand side for each direction of travel.

On **multilane roads**, all repeater signs must be gated to ensure that vehicles in the offside lane can see a TSL sign.~~On all roads with more than one lane for the direction of travel, all repeater TSL signs must be gated~~

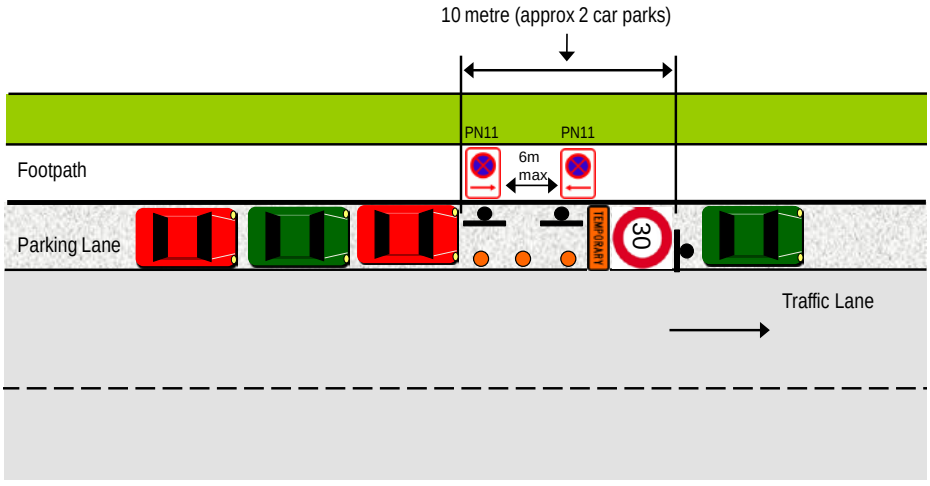
C3.3.2 Positioning of signs

Signs must be located in a manner such that the safety of road users, including pedestrians and cyclists, is not affected.

Signs must not be placed in a marked cycle lane or on a footpath unless it is safe to have them there. A delineation device, such as a cone, must be placed next to a sign erected in a cycle lane or on a footpath so that the extent of encroachment of the sign base into the cycle lane or footpath is clearly delineated.

All traffic signs must be positioned to ensure they are:

- upright
- 0.5m clear of the travelled path, wherever possible, on **level LV** and **level 1** roads
- 1.25m clear of the travelled path wherever possible, on **level 2** and **level 3** roads
- not obscured by parked vehicles, trees or other obstructions. In a less than 65km/h area, a 10m clear space must be provided as shown in the diagram below



- not encroaching on a marked cycle lane
- not encroaching on a footpath unless:
  - adequate footpath width remains as per section C13 Pedestrians and cyclists
  - any protruding edges of the sign and base are delineated by cones to aid sight-impaired pedestrians
- not a hazard to road workers or road users, including cyclists
- not obscuring view of other signs, devices or other traffic on the road
- not directing traffic into incorrect or dangerous situations
- kept clean in accordance with maintenance standards especially in dusty or muddy conditions
- removed or covered when the activity ceases, and
- sign bases must not be left in place, without signs attached, in a manner that will be a hazard to any road user, including pedestrians and cyclists.

All signs must be mounted on stands (or in the case of road closures, signs may be mounted on a barricade/barrier).

At least one delineation device must be placed at the base of each sign stand on the side closest to traffic:

- on levels 2 and 3 at all times
- on levels LV and 1 at night
- on any other roads when required by the RCA/TMC
- unless more are specified on the TMP.

Where worksite restrictions such as local topography, median barriers, or bridges preclude the placing of the required signs either:

- the signs must be moved away from the site restriction and additional signs provided, or
- smaller signs may be used, subject to the approval of the RCA and engineer.

Subject to application via a TMP and approval by the RCA, median barrier brackets may be used to support TTM signs.

Note: When a sign on a barrier is removed, the bracket must also be removed.

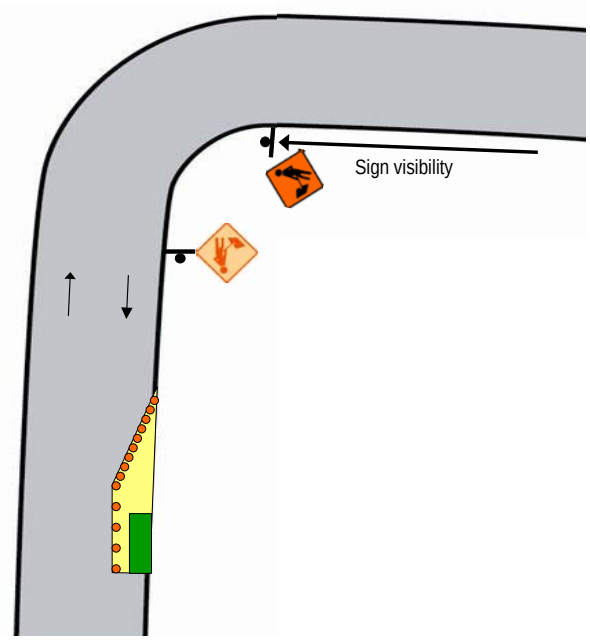
Details of any variations to the standard placement of signs must be specified by the site traffic management supervisor (STMS) on the TMP where applicable, or associated on-site record and hazard identification form.

Minor variations to the normal placement of signs must be noted by the STMS/TC on the on-site record.

C3.3.3 Sign visibility

If a sign placement is required at a position where it does not meet the NZ Transport Agency's *Traffic control devices manual* part 8 Code of practice for temporary traffic management (CoPTTM) sign visibility distance (layout dimension A), the sign should be **advanced up to one sign spacing** (layout dimension C).

If it still does not meet the sign visibility distance requirements, a sign should be erected in the original position and an additional sign placed one sign spacing in advance of the original position.



The aim is to give road users sufficient warning ~~to slow down~~ when approaching the worksite.

~~Details of any variations to the standard placement of signs must be specified by the site traffic management supervisor (STMS) on the TMP where applicable, or associated on-site record and hazard identification form.~~

C3.4 Sign height

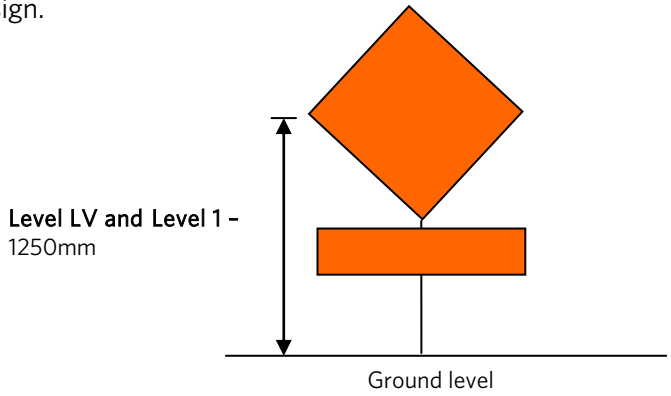
C3.4.1 Minimum height of signs

Signs must be installed to the minimum heights given in the following table.

Road level	Minimum height from ground level to lowest edge of sign	Minimum height from ground level to middle of main sign
Level LV and level 1	N/A	1250mm
Level 2 and level 3	1000mm	N/A

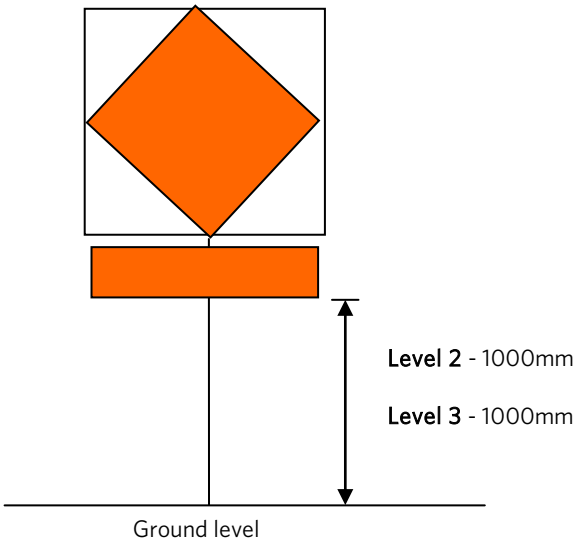
C3.4.2 Level LV and level 1

1250mm minimum height from ground level to **middle** of diamond-shaped sign.



C3.4.3 Level 2 and level 3

1000mm minimum height from ground level to **lowest edge** of sign.



C3.5 Quality of signs, stands and/or supports

Refer to section C19 Maintenance standards for details of the quality of signs, stands and/or supports.

C3.6 Covering permanent signs

C3.6.1 Covering existing signs

Road users could be confused if the information on existing signs is not applicable at a worksite.

The RCA may approve the altering, covering or replacing signs to suit the worksite circumstances. It is essential that any signs at the worksite visible to road users accurately represent the prevailing conditions at all times.

All permanent signs that no longer apply during the ~~work~~ activity phase must be covered, removed, or temporarily modified. However for short-term operations, overhead gantry signs do not need to be covered unless required by the RCA.

Temporary signs must not be allowed to obscure existing permanent signs that still apply.

Permanent signs covered, removed or temporarily modified during the period of ~~work~~ activity must be restored during uplift of the closure, unless the ~~work~~ activity involves permanent removal or replacement of the permanent signs.

The material used to cover any permanent signs, which no longer apply during the ~~work phase~~activity, must prevent all road users viewing the sign and also reflection from vehicle's headlights at night.

Non-adhesive material must be used to cover permanent signs that are not applicable for the duration of the work. Adhesive material will damage the reflective material on the sign reducing its night time visibility.

Note: Some materials that are non-breathable and/or plastic may cause heat damage or moisture damage to the reflective surface.

The material used to cover the signs must be:

- durable
- opaque
- breathable/non-condensation forming, and
- securely fastened.

Spray-on masking materials **must not** be used to cover up permanent signs because the removal process may damage the sign surface.

C3.6.2 Covering curve advisory signs

Curve advisory signs must only be covered where the advisory speed value is higher than the TSL imposed.

In this situation, the supplementary speed plate **must** be covered and the yellow diamond-shaped sign indicating the type of the curve **must** remain visible to road users.

An additional TSL sign RS1 and TG1 (RG-4) may be placed adjacent to any curve advisory sign that has been covered because the supplementary speed plate has higher speed value than that of the TSL at the worksite.

C4 Temporary speed limit (TSL)

C4.1 Introduction

C4.1.1 Purpose

The installation of a TSL helps to control traffic at temporary hazards and for special events.

The TSL gives positive direction and guidance and, if set at an appropriate level, should receive a good level of compliance.

C4.1.2 Land Transport Rule: Setting of Speed Limits 2003

The TSL requirements in CoPTTM are in accordance with the Land Transport Rule: Setting of Speed Limits 2003 and subsequent amendments.

C4.1.3 Authorising TSLs

The RCA, or a person with delegated authority, must authorise the setting of a TSL for a worksite.

The TSL is authorised when the TMP is approved. The TMP includes details of the TSL and the approximate length (eg TSL 30km/h for 70m).

Any change to the authorised TSL needs to be approved by the RCA or a person with delegated authority.

C4.1.4 General

The speed limit should not exceed the maximum safe travel speed for the conditions.

In determining a TSL, consideration should be given to:

- the danger to all road users
- the degree of pedestrian and vehicle activity
- the type and extent of the activity ~~work~~ in progress
- the danger to road workers, and
- the characteristics of the road (eg the driving conditions of the site).

A TSL must:

- be authorised by the RCA or person with delegated authority
- have a drop in speed of 20km/h or more from the existing permanently gazetted speed limit
- be reduced in multiples of 10km/h
- be appropriate to the condition of the road, and
- not be lower than 20km/h.

C4.2 Requirements

C4.2.1 When TSLs may be needed

TSLs must be appropriate for the type of worksite activity and the condition of the road surface.

TSLs may be needed where one or more of the following conditions exist:

- there are loose materials or stones on a sealed road which has been repaired or reconstructed
- the surface of the road is being sealed or resealed
- personnel or equipment, and their associated safety zones encroach on the existing lanes
- visibility is restricted while travelling through the worksite due to dust, work equipment, construction materials or abnormal weather conditions
- the alignment, width or road surface is reduced to a standard lower than adjacent sections of road
- the safety of road workers and road users could be affected
- emergencies, eg flooding, slips, crashes
- single-lane traffic operation of a two-lane two-way road
- a reduced number of lanes is available
- there is reduced lane width
- there are good technical reasons (eg the road might otherwise collapse)
- the surface has been damaged due to slip or subsidence
- non-useable shoulders that are completely out of character with the approaches and with the normal condition of the road
- there are road features such as extremely poor alignment or detours.

In these situations, the nature of the roadway deficiency (or the traffic control devices) should be evident to motorists so that they recognise the need to adjust their speed.

Note:

- This list is a guide only and does not include all possible activities.
- TSLs are not mandatory for warning signs for ice grit.

C4.2.2 TSL decision matrix worksheet

The TSL decision matrix worksheet can be used to determine if a TSL is required and, if so the, appropriate TSL. This can be attached to the TMP to justify the TSL selected. Refer to section E, appendix B Temporary speed limit (TSL) decision matrix worksheet.

C4.2.2.1 Procedure for using the TSL decision matrix worksheet

Start point

The potential need for a TSL is identified.

Process

For each of the four categories on the worksheet (1. Minimum lane width, 2. Pavement/surface condition, 3. Visibility and alignment and 4. Worksite clutter):

- rate the worksite and decide if it is excellent, average, below average or poor
- decide whether the worksite is in the upper or lower range of the rating you have selected
- record the possible TSL for that category in the circle provided on the right.

Transfer the lowest possible TSL to the bottom circle.

If the lowest TSL is at least 20km/h below the permanent speed limit that TSL should be applied.

Use several worksheets if more than one TSL is required within a worksite.

Once the need for a TSL has been determined the following principles are to be used:

- The speed limit should not be so low that road users disregard it.
- The maximum safe speed is lowered by frequent hazards and potential worksite conflicts.
- Speed limits should encourage a uniform speed but should be low enough to allow road users time to react to unusual events or to directions from MTCs.
- Inappropriate use of TSLs leads to a reduction in compliance by road users. Their effectiveness is reduced when used in other situations where they could have a positive benefit to road safety.
- A speed limit set too low will result in higher speeds and a greater mix of speeds, both of which increase the safety risks to road users and personnel.

Refer to section C10 Positive traffic management for details of the positive traffic management to be used in conjunction with a TSL.

C4.2.3 Setting realistic TSLs

It is important that any TSL reflects the condition of the worksite at any given time. Therefore TSLs need to be realistic for the conditions.

If the TSL is not realistic, drivers will often ignore it. This can lead to reduced compliance with all TSLs.

In addition, the police may have difficulty justifying the enforcement of TSLs that are obviously not appropriate for the conditions.

To improve driver compliance, varying the TSL may be appropriate in the following circumstances:

- **Within a long worksite (over 400m)**

  For example, where a long worksite is established with say a 70km/h TSL, but activity ~~active work~~ is concentrated within a specific area and a lower TSL (say 30km/h) can be used for that stretch of road where the activity ~~work~~ is concentrated

- **Over the activity ~~work~~ period**

  Different stages of works may require different safety levels and therefore higher or lower TSLs may be appropriate for each stage

- **Over a 24-hour period**

  A higher TSL might be more appropriate within an established worksite during a period when workers are not at the worksite (eg at night).

C4.2.4 Avoid progressive speed limits (buffer zones)

Progressive speed limits (sometimes called 'buffer speed limits') in advance of a closure, eg 70km/h followed by 50km/h followed by 30km/h, that are not justified in terms of the surrounding activity have proven to be ineffective in reducing traffic speeds.

Progressive speed limits should not be used and, where necessary, repeater TSL signs should be used to reinforce the temporary speed message.

C4.3 Location of TSLs

C4.3.1 Sign location

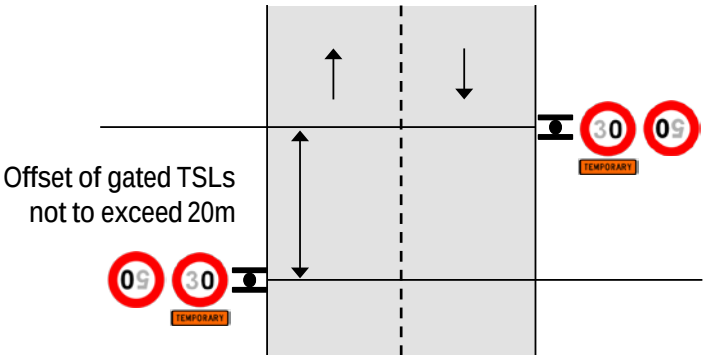
At every change in speed ~~(TSL or derestriction)~~ the speed signs must be gated across the road (signs placed on both sides of the road facing towards oncoming traffic).

The gating of speed signs is not required on roads with an AADT of less than 500 vehicles.

The appropriate RS1 (RG-1) and TG1 (RG-4) sign must be used for TSLs.

~~A speed derestriction must be to the relevant permanent speed limit - RS1 (RG-1), RS2 (RG-2) or RS3 (RG-2.1).~~ The relevant permanent speed sign RS1 (RG-1), RS2 (RG-2) or RS3 (RG-2.1) must be placed at the end of every temporary speed limit.

These gated TSL signs must not be offset by more than 20m along the road.



Any side road entering an area subject to a TSL must also have a TSL and the relevant permanent speed limit installed to derestriction signage installed the TSL.

Signs for the return to the relevant permanent speed limit TSL derestriction signs - RS1 (RG-1), RS2 (RG-2) or RS3 (RG-2.1):

- **On two-way two-lane roads** must be placed on each side of the road at the same point as the TSL for the opposite direction.
- **On one-way roads** the TSL these maymay be erected placed with the Works End sign as a supplementary plate. The signs are to be placed a distance from the hazard as specified by the sign spacing distance for that level of road.

On **levels 2 and 3** roads cones are required from the TSL sign to the start of the taper or hazard area where no taper is installed. Where the edgeline is well defined (ie by a clean kerb and channel) this line of cones is not required.

Note: The police can be asked to legally enforce a TSL if road users are not obeying the restriction and are creating an unnecessary hazard for road workers, the road surface or other road users. The TSL can only be enforced if the worksite is set out to the requirements of the approved TMP.

C4.3.2 Road works on side road close to intersection

When road works on a side road are close to an intersection the TSL is often placed on the main road. This can cause unnecessary disruption for traffic travelling on the main road.

Where there is a **90 degree** turn that will slow turning vehicles to approximately **20km/h** the following formulae may be used.

Location of the TSL on the intersection of a side road with permanent speed limit...	
50km/h or less	Provided a TSL can be placed 15m from the intersection and 15m from the worksite taper (total of 30m) , a TSL would not be required on the main road.
60km/h	Provided a TSL can be placed 15m from the intersection and 25m from the worksite taper (total of 40m), a TSL would not be required on the main road.
70km/h or more	Provided a TSL can be placed 15m from the intersection and 40m from the worksite taper (total of 55m) , a TSL would not be required on the main road.

C4.4 General requirements for TSLs

C4.4.1 Repeater signs

On long worksites TSL signs must be repeated at intervals no greater than 400m, as a reminder to road users of the maximum speed they may travel past, or through, the worksite.

On **two-way two-lane** roads these repeater signs need to be installed at 400m intervals on the left-hand side of road users travelling through the worksite.

On **multilane roads**, all repeater signs must be gated to ensure that vehicles in the right hand or centre lanes can see a TSL sign.

These signs must always be erected on the left-hand side of the road before additional signs are erected on the right-hand side of the road.

C4.4.2 Duration

TSLs must be removed as soon as the circumstances under which the speed restriction was imposed no longer exist.

TSLs can only be approved for up to six months.

Should a TSL be required for more than six months, the RCA must review the TSL, and if it is still required, a new TMP must be approved.

C4.4.3 Long-term performance deficiencies

A TSL would **not** normally be used where a road has a long-term deficiency not caused by road works (eg poor alignment or slippery surface).

It is more appropriate in these circumstances to use a permanent warning sign with a yellow background (eg WR3).

C4.4.4 Covering existing speed limits

When placing a TSL, any existing speed signs within the TSL area that show a speed other than the TSL must be covered (except for an overhead gantry).

For short-term worksites involving a gantry, repeat the TSL after the gantry (as it is difficult to cover the speed sign).

Long-term worksites are treated on a case by case basis. The STMS must ensure their TMP covers any requirement to obscure larger permanent signs.

C4.4.5 Recording details of the placement of TSL

The placement of the TSL signs sets the speed limit. To be legally enforceable the location and time of placement of the TSL must be recorded.

Details of location of the TSL must be recorded in either the:

- on-site record, or
- company documentation (if it contains the same TSL information as the on-site record).

The details that must be recorded are:

- date and time TSL installed
- placement (route positions, house numbers or relative to a fixed point such as culvert or bridge marker)
- length of TSL (m)
- date and time removed.

The accuracy of details is to be within ±20m.

The details of the placement of the TSL must be retained for at least 12 months, or longer if the worksite is under investigation.

C4.4.6 Excessive or inappropriate use of TSLs

If during an audit of a worksite it is determined that there is excessive or inappropriate use of TSLs contravening section C4 Temporary speed limit (TSL) (eg leaving in place a 30km/h TSL once works have been removed or finished) **a non-conformance will be issued, regardless of the overall worksite condition rating**.

C5 Delineation devices

C5.1 Introduction

C5.1.1 General

All delineation devices must meet the requirements in section B2 Delineation devices.

For short-term worksites the form of devices should superimpose themselves on the permanent system to the extent that they dominate it by size, colour and reflectivity.

Permanent road markings should not be altered for short-term worksites.

For long-term worksites on **level 2** and **level 3** roads the permanent road markings should be modified to reflect the revised situation.

Cones and other delineation devices are used for a variety of applications within a worksite. These devices are usually placed in the direction and protection zone of a worksite.

Different types of devices should not be mixed or used over distances of less than 100m.

C5.2 Use and placement of delineation devices

C5.2.1 Use

Cones and tubular delineators are mainly used to mark tapers and to form temporary traffic lanes.

Barrels are used to convey bulk. Where used to separate road users from non-frangible objects, such as concrete barriers or parked plant, an RD6L (RG-17) or RD6R (RG-34) sign must be placed alongside the barrel. Alternatively, the first barrel in a row of barrels can be placed to indicate the appropriate side on which road users are to pass.

The use of steel drums is prohibited.

C5.2.2 Placement

Delineation devices must be placed in accordance with the appropriate layout distance tables for levels LV, 1, 2 and 3 in C2 Worksite layout.

These devices must be installed in straight lines and/or smooth curves to help road users travel past the hazard.

On all **level 2 and 3 layouts** cones must be installed along the edgeline, from the first RS1 (RG-4) TSL sign to the start of the taper or working space where no taper is installed.

Where the edgeline is well defined (ie by a clean kerb and channel) this line of cones is not required.

C5.2.3 Edge delineation

Edge marker posts **do not** meet the requirements for temporary delineation and they must not be used for TTM.

Edge delineation with existing marker posts and/or raised pavement markers (RPMs) must be maintained where the edge of the carriageway remains unaltered during the roadwork activity.

Where traffic is required to deviate from their normal path of travel or the nature of the activity requires shoulder reconstruction and/or the removal of the edge marker posts, temporary delineation must be installed.

Where a hazard is created, side delineation must be used to guide the road user past the hazard.

Permanent edge marker posts and/or RPMs must be reinstated before the removal of the temporary delineation devices.

Edge marker posts that conflict with temporary delineation may either be covered or removed.

C5.2.4 Cone bars

Cone bars are light weight, striped orange and black, or yellow and black plastic poles with rings at each end to connect cones together.

They may be used to provide a channel for pedestrians on sites where workers are in attendance. These may be used for guidance but must not be used to replace a safety fence.

C5.3 Quality of delineation devices

Refer to section C19 Maintenance standards for details of the quality of delineation devices.

C6 Safety zones

C6.1 Introduction

C6.1.1 General

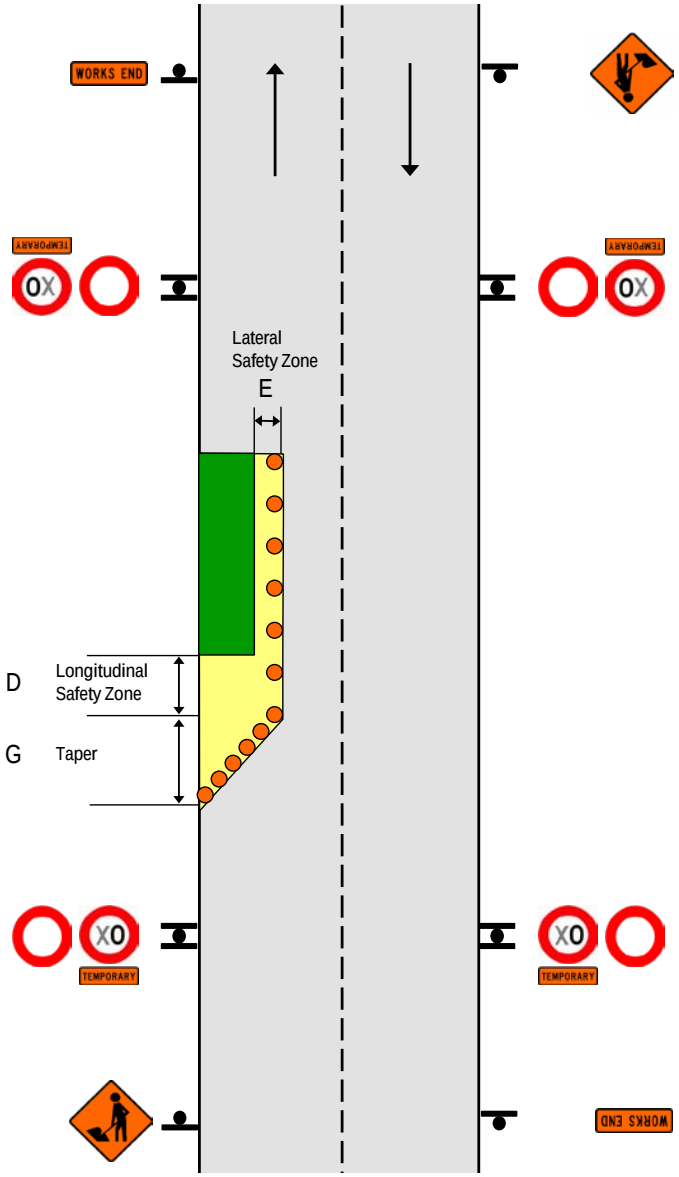
Safety zones provide additional protection for road workers and road users.

The safety zones are three dimensional extending from the front, the sides and above the working space.

The safety zones include the coned tapers, even though these areas are **not** included in the longitudinal safety zone dimension.

The safety zones (including coned tapers) must be clear zones. This means no truck-mounted attenuators (TMA), arrow boards, equipment storage, stockpiling, working or walking in the safety zones.

Signs and delineation devices are the only pieces of equipment allowed in the safety zones.



C6.2 Safety zone requirements

C6.2.1 Working space

An adequate working space must be provided within the closure to allow for the movement of workers, equipment, materials and vehicles, including sufficient waiting and storage space for the above items.

The working space may vary during the period of the activity ~~work~~ and need not be a constant width.

C6.2.2 Longitudinal (lead in) safety zones

A longitudinal safety zone is the initial portion of a closed lane in advance of the working space.

Longitudinal safety zones are measured from the end of the taper leading into the working space to the start of the hazard.

Minimum lengths for longitudinal safety zones are given in the layout distance tables for levels LV, 1, 2 and 3 in section C2 Worksite layout.

Where longitudinal safety zones cannot be achieved on **level 2** roads a TMA must be installed to provide safety for road users, road workers and equipment. This must be specified on the TMP and approved by the RCA.

C6.2.3 Lateral safety zones

Lateral safety zone is the minimum distance from the edge of the live lane to the edge of the working space.

There must be a safety zone between the working space and the edge of the live lane.

C6.2.4 Overhead safety zones

At all worksites where activity ~~work~~ is being carried out above the road, all road users must be adequately protected from falling objects by nets, platforms or other devices, or alternatively the respective part of the carriageway must be closed.

Where the activity ~~work~~ will impose a temporary height restriction, eg a safety platform or falsework underneath a bridge soffit, the RCA must approve it. Road users must also be warned of the temporary height restriction.

The maximum legal vehicle height permitted on roads is 4.25m but road users often illegally exceed this limit.

C6.2.5 Working in safety zones

STMS/traffic controllers (TC) may enter a safety zone to place, replace and remove TTM equipment, as necessary.

In accordance with inspection requirements for the level of road, personnel may enter a safety zone to maintain TTM equipment.

C6.2.6 Dimensions of safety zones

The dimensions of safety zones are given in section C2 Worksite layout.

C7 Tapers

C7.1 Introduction

C7.1.1 General

Tapers are used to move traffic from its normal travel path to a temporary travel path around, or through, a working space.

Tapers are created by placing a number of delineation devices, usually cones or other suitable delineation devices, in a straight line or smooth curve across the width of the lane that is no longer available for use.

C7.1.2 Taper devices

Devices used in tapers must meet the specifications described in section B2 Delineation devices.

C7.2 Types of taper

C7.2.1 Shifting tapers

Shifting taper is used where traffic is simply required to shift laterally without conflict with other traffic.

On **levels LV, 1 and 2**, two-lane two-way roads that have been reduced to one lane and are being used alternately by traffic in each direction, the taper can be reduced to 30m provided a TSL of 20km/h or 30km/h is imposed and cones are spaced at 2.5m centres.

MTCs, portable traffic signals, or priority give way signs (less than 1000vpd) are always used to control this situation.

C7.2.2 Merging tapers

Merging taper is used on multilane roads where one lane of traffic must merge into another lane.

Merging must only be carried out one lane at a time. Where more than one merge is required, the subsequent merge(s) may use a taper rate greater than the initial taper, provided a TSL has been applied prior to the initial taper.

C7.2.3 Multiple tapers

Closures of more than one lane require multiple tapers. Lane closures must be effected one lane at a time. The distances between multiple tapers are given in the layout distance tables for levels ~~LV,~~ 1, 2 and 3 in section C2 Worksite layout.

C7.2.4 Chicanes

A chicane involves merging multiple lanes of traffic into a single lane prior to a shift laterally around the working space.

Chicanes are only used on level 3 roads and passing lanes.

The benefits of chicanes are:

- better controlled merging of the various lanes particularly the higher speed right-hand lane
- worksite layout approaches are uniform
- traffic is calmed by lane merging and shifting well in advance of the working space
- optimum capacity and improved safety through the worksite.

When merging traffic on a passing lane the use of chicanes is essential unless the lane is completely closed.

Chicanes are used where there is a sufficient length of road free of intersections.

Chicanes are most frequently used when activity ~~work~~ is being ~~carried out~~undertaken in the left lane but they may also be used in other situations.

C7.3 Taper visibility and length

C7.3.1 Taper visibility

Tapers should be located so that their full length is visible to approaching traffic.

Where this is not possible at least two thirds of the taper must be visible.

If this cannot be achieved the taper length must be extended so that the two thirds requirement can be achieved.

C7.3.2 Taper length

The length of taper depends on the speed limit and the lateral shift.

Tapers are specified as a taper length for all TTM levels and are given in the layout distance tables for levels LV, 1, 2 and 3 in section C2 Worksite layout.

Taper lengths shown on these tables are based on a lateral shift of 3.5m.

For levels 2 and 3 roads initial tapers are based on the permanent speed limit and after this taper and longitudinal safety zone the layout of the worksite including any subsequent tapers are based on the TSL.

C7.3.3 Lengths of tapers for a lateral shift of less than 3.5m

Taper lengths are based on a lateral shift of 3.5m, which generally equates to the width of a live lane.

For lateral shifts of less than 3.5m the length of the taper may be reduced. The reduction in the length of the taper is calculated as follows:

(the lateral shift ÷ 3.5) x the taper length for a 3.5m shift.

Example: **level 1** road – 100km/h:

- lane width = 3.5m
- taper length for 3.5m shift = 100m
- lateral shift required = 2.7m.

  Revised taper length = (2.7m ÷ 3.5) x 100 = 77m

The following table shows conservative taper lengths for given lane shift widths.

Shortened taper lengths for lane shifts/closures of less than 3m

Level 1 taper lengths in metres and (cone numbers)												
Closure or lane shift width	50km/h		60km/h		70km/h		80km/h		90km/h		100km/h	
> 3.0	Apply the full taper length											
2.0 – 3.0	**25**	(11)	**35**	(15)	**50**	(11)	**60**	(13)	**70**	(15)	**85**	(17)
1.0 – 2.0	**15**	(7)	**25**	(11)	**30**	(7)	**35**	(8)	**40**	(9)	**45**	(10)
< 1.0	**5**	(3)	**10**	(5)	**15**	(4)	**25**	(6)	**30**	(7)	**35**	(8)

Numbers in brackets are the cone numbers required.

C7.3.4 Taper length where shoulder is less than 2.5m

On all levels of road 10m long shoulder tapers with at least 5 cones at no greater than 2.5m spacings are permitted where shoulder width is less than 2.5m and works do not affect live lane.

C7.3.5 Taper length where there are road environment constraints

On level LV and level 1 roads where there are road environment constraints (including intersections and commercial accesses) a 10m taper may be used for speeds 50km/h and under.

This does not apply on state highways or where portable traffic signals, MTC (stop/go) or priority give way are used.

If a 10m taper is used, delineators in the taper must be placed at 1m centres.

Note: Where MTC (stop/go), portable traffic signals or priority give way are used, tapers may only be reduced to 30m.

C8 Shoulder and lane closures

C8.1 Introduction

C8.1.1 General

Shoulder closures are used to provide minimal disruption to traffic on all roads where the works are restricted to a trafficable shoulder that is typically 2m or more wide.

Lane closures are used to protect the working space. Traffic is directed into another lane and guided past the working space.

C8.1.2 Shoulder closures

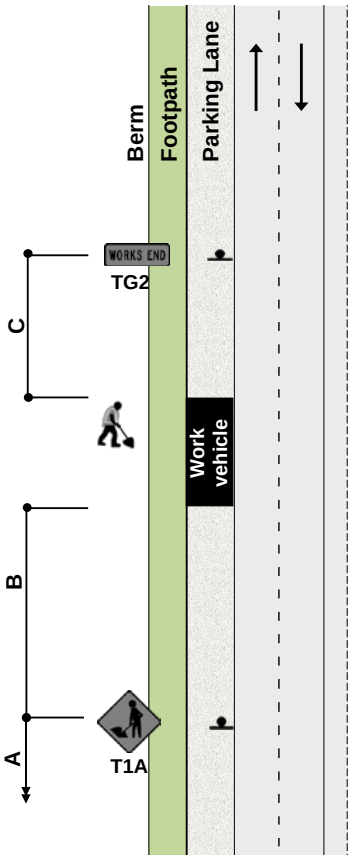
If the ~~work~~ activity is on a sealed or unsealed shoulder, the shoulder should be closed with a T138 (TW-1.6) Shoulder Closed supplementary plate attached to the T1A/T1B (TW-1) road works sign.

C8.1.2.1 Shoulder closure on level LV, level 1 and 2 roads with speed limits of less than 65km/h

On level LV, level 1 and level 2 roads with speed limits of less than 65km/h, activity ~~work~~ may be carried out as follows:

C8.1.3

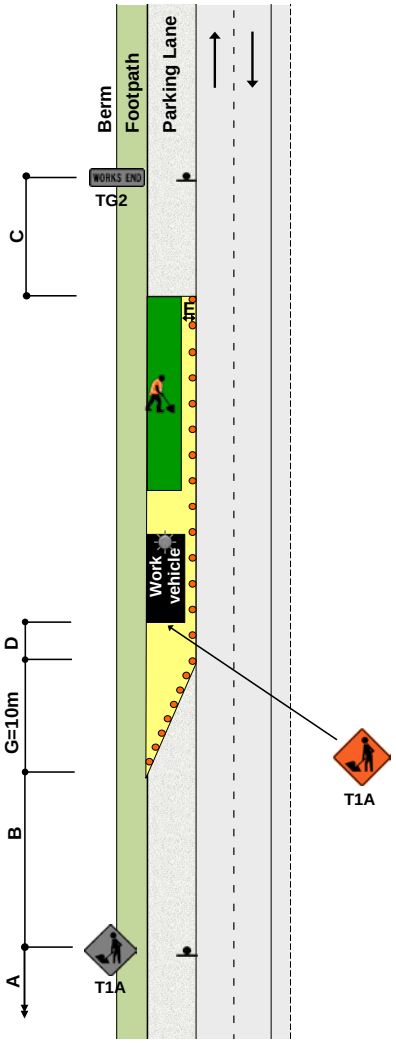
- Activity ~~Work~~ on the berm or footpath does not require advance warning, however, traffic management must be provided where pedestrians or cyclists are affected
- ~~Where work is carried out on the berm or footpath, and a work vehicle is parked in a legal parallel car park, provided the vehicle is only accessed from the off-traffic side, advance warning T1A/B (TW-1) and works end TG2 (TW16) are optional~~Advance warning T1A/B (TW-1) and works end TG2 (TW16) are optional if:
  - the work vehicle (light truck or smaller) is parked in a legal parallel car park, and
  - vehicle is only accessed from the off traffic side
- Large plant and machinery must not be used in this situation; a more substantial closure is required.



C8.1.3.1 Shoulder closures on level LV and level 1 roads

Where activity ~~work~~ is carried out in the legal parking lane, the following minimum standard of TTM must be provided:

- a 10m taper ~~in front of the work vehicle~~
- a longitudinal safety zone
- cones alongside the work vehicle and the working space
- a 1m lateral safety zone along the working space
- a T1A (or other appropriate advance warning sign) mounted on the back of the work vehicle
- the work vehicle is no larger than a light truck. Large plant and machinery must not be used in this situation; a more substantial closure is required.



T1A (TW-1) road works and TG2 (TW16) works end signs are optional.

These layouts must only be used during daylight hours.

C8.1.4 Lane closures

A lane should be closed to traffic whenever an activity is carried out:

- such that passing traffic is required to cross a lane line, or cross a centreline and it is not possible to retain the existing number of lanes
- where the air space up to 6m over the area is occupied by the activity or where there is a risk of objects falling from above
- in a location where the combination of signing and physical restriction created by the working space plus safety zone will not result in a satisfactory reduction in traffic speed to maintain a safe working space
- where there is insufficient room to maintain the same number of traffic lanes past the closure as is on the approach to the worksite while satisfying the minimum lane width requirements.

C8.1.5 Length

The length of shoulder and lane closures must be kept to a minimum while ensuring the longitudinal safety zones are still provided.

The length of the working space must not exceed 1km for shoulder and lane closures without specific approval from the RCA.

Shoulders and lane closures should be shortened as activity ~~work~~ progresses along the road.

C8.1.6 Lane widths

Shoulder closures and lane closures must be such that the minimum lane widths given in the layout distance tables for level LV, 1, 2 and 3 roads in section C2 Worksite layout and in the lane width table in subsection C2.7 Lane widths are always provided.

These lane widths are the clear lane widths and are exclusive of delineation devices, safety zones and road markings.

Temporary lane widths must not exceed 4m.

Worksites with a high proportion of heavy vehicles may require lane widths greater than the minimum widths specified.

C8.2 Lane closures/shifts

C8.2.1 Signs used for lane closure

Lanes must be closed with a TL2L/R (TW-7), TL3L/TL33 (TW-7.1) or TL4 (L/R) (TW-7.2BL/R) lane closure sign, as detailed in subsection B1.4.2 Direction and protection to warn road users that normal lanes are not available.

Lane closure signs are only placed in advance of the start of the taper and are not required at the start of the taper.

C8.2.2 Level LV and level 1 lane closures

The lane closure sign **does not** require a supplementary sign displaying the distance to the lane closure.

The sign is placed in advance of the taper at the appropriate distance as per the layout distance tables for levels LV, 1, 2 and 3 in section C2 Worksite layout.

C8.2.3 Level 2 lane closures

The lane closure sign **requires** a supplementary sign displaying the distance to the lane closure.

Depending on worksite requirements, the first lane closure sign is placed at least one sign spacing ~~100m or a multiple of 100m~~ in advance of the start of the taper.

For multiple lane closures, the second lane closure must be signed at least one sign spacing~~100m~~ in advance of the start of the second taper.

Multiples of 100m may be used instead of the sign spacing.

C8.2.4 Level 3 lane closures

There must be two lane closure signs. Each sign requires a supplementary sign displaying the distance to the lane closure.

The first lane closure sign must be placed 400m in advance of the start of the taper.

The second lane closure sign is placed at a distance of 200m from the start of the taper.

For multiple lane closures, the second lane closure must be signed 100m in advance of the start of the second taper.

C8.2.5 Centre lane closures

On roads with three or more lanes in one direction, centre lane closures are not permitted.

Exception

The only exception to this is a level 1 road which is not a state highway and has a permanent speed of 50km/h or less.

In this exception only, centre lane closures are permitted provided:

- traffic merges only in one direction
- there is a definite lane shift (either left or right), and
- tapers move traffic to the side of greatest capacity.

In all other cases, where activity ~~work~~ must be conducted in a centre lane, the lane(s) on either the left **or** right must also be closed.

On **level 3** roads it is recommended that the right-hand lane be closed.

On **level 1** and **level 2** roads the other lane to be closed must be stipulated by the contractor in their TMP and reviewed by the RCA or delegated person who has the ultimate decision as to which lane is closed. Consideration should be given to intersections, including turning bays, when choosing the lane to be closed.

C8.2.6 Lane shifts

The signing of lane shifts follows a similar pattern to that for lane closures but implies simultaneous lateral shifts of lanes rather than merging of one lane with another.

Lane shifts are only signed when **two or more lanes in one direction must shift simultaneously** past a hazard.

Lane shifts are indicated with TL5L/R (TW-8) and TL6L/R (TW8.1) signs.

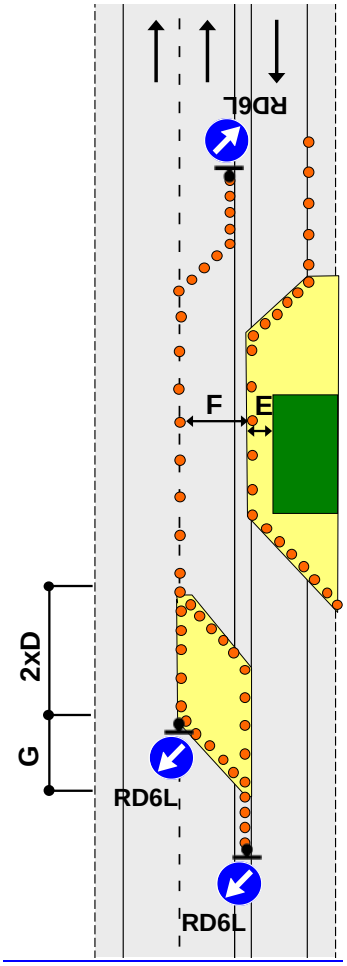
Lane shift signs are not required for **two-lane two-way roads**. In these situations an RD6L (RG-17) sign must be installed at the start of the row of delineation devices that separates the opposing traffic flows.

On **level 2** and **level 3** roads the lane shift signs require a supplementary sign displaying the distance to the lane shift. Where traffic has to shift twice it may not be appropriate to display the distance to the second shift, especially at short worksites.

C8.2.7 Contraflow on multilane road

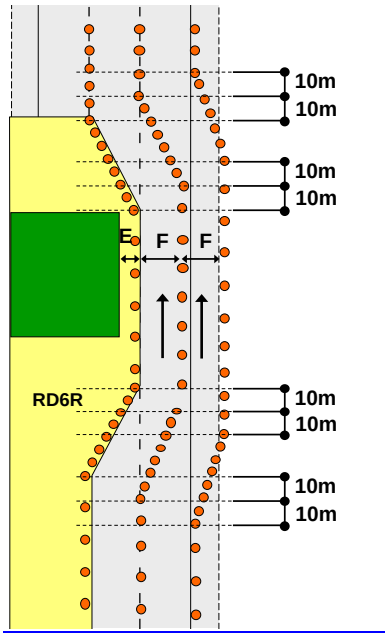
Where a contraflow is established on a multilane road, a longitudinal safety zone of 2xD is to be established to provide separation of vehicles.

See diagram below.

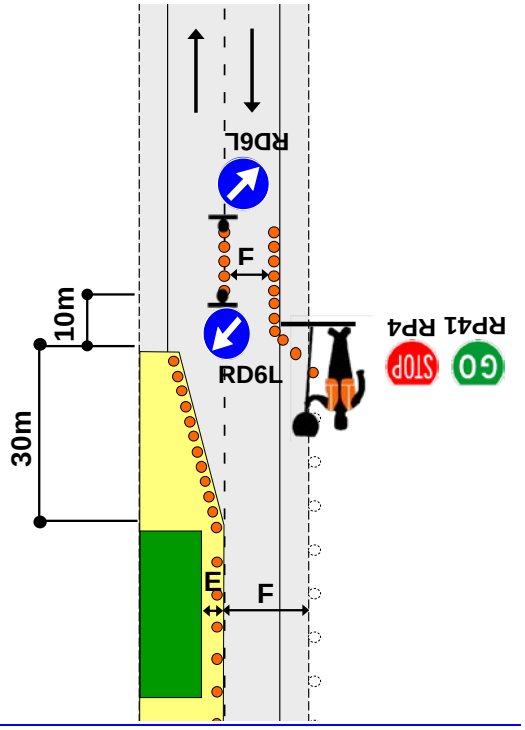


C8.2.8 Allowing heavy vehicles room to manoeuvre

Cones in a channel must be offset by a minimum of 10m where the direction changes to allow for heavy vehicles to manoeuvre without hitting the cones. See diagram below.



On all cone thresholds, 10m must be left between the closure and the cone threshold to allow for heavy vehicles to manoeuvre. See diagram below.



~~C8.2.7~~C8.2.9 Using the shoulder as a temporary lane

If the traffic demand expected is likely to exceed the capacity of the road during ~~work~~ activities the shoulder may be used as a temporary lane.

A shoulder used as a temporary lane must:

- be safe for traffic to traverse at the given TSL
- be checked by the engineer to ascertain that the shoulder is strong enough to carry heavy vehicles
- be at least the minimum width for the speed through the worksite
- have adequate overhead clearance
- have adequate visibility along its length (vegetation may need to be trimmed and traffic signs moved, with the permission of the RCA)
- not have a surface level height difference of more than 25mm from the adjacent traffic lane for multiple lane situations where the shoulder is used as one of those lanes and
- be delineated on both sides unless travel paths are clear.

~~C8.2.8~~C8.2.10 Presence of intersecting roads and on- and off-ramps

~~C8.2.8.1~~C8.2.10.1 Work on level LV and level 1 roads – signs required on level 2 road

A level 1 sign can be used on a level 2 road when indicating that activity ~~work~~ is on the level LV or level 1 road.

The signs may be placed on the level 2 road without the need for a mobile operation provided:

- the sign placement can be carried out safely from the footpath or berm
- no signs or cones are walked across the road unless a pedestrian crossing is used
- any vehicles involved are parked off the road, preferably around the corner on the level LV or level 1 roads.

A level 1 STMS (not a TC) must take charge of the worksite when the level 1 signs are placed on the level 2 road.

~~C8.2.8.2~~C8.2.10.2 Work on level 2 and 3 roads - signs required on level LV or level 1 roads

When the worksite is on a side road of a higher level (say level 2) than the road where the advance warning signs are required (say level 1) then the advance warning signs may be in accordance with the lower level.

~~C8.2.8.3~~C8.2.10.3 Level LV, 1, 2 and 3 roads

Where lanes are closed through intersections the delineation devices must allow for turning movements of the vehicles entering or leaving from side roads.

Where side roads have two or more lanes turning into the main road that has lanes closed because of the activity~~work~~, tapers must also close the respective lanes on the side roads.

Lane closure tapers should not start within 50m of an intersection on **level 2** roads. This distance is extended to 100m clear of any ramp or intersection on **level 3** roads measured from the point where the merge area finishes, or where the diverge area commences.

If the ~~work~~ operation blocks a side road and a MTC cannot direct the traffic around the closure then a detour may be required, refer to section C9 Road closures and detours.

Merging of traffic from a side road having two lanes at the intersection into a road with only one lane at a worksite is unsafe. The number of lanes on a side road must not exceed those available for road users bypassing the closure.

~~C8.2.9~~C8.2.11 Work at or near signalised intersections

Work that significantly alters approach speeds, traffic density, lane availability or approach alignment can significantly affect traffic signal operation.

Work that damages vehicle detection systems, hardware or cabling, or generates spurious demands, may also severely affect signal operation. Vehicle detector loops may extend up to 120m in advance of the painted limit line.

Therefore, where the activity~~work~~ occurs at or adjacent to existing signalised intersections the RCA must be advised at least five working days prior to commencement of any activity~~work~~.

Where multiple signalised intersections occur close together the taper lengths may need to be altered or lane closures extended.

~~C8.2.10~~C8.2.12 Work at or near roundabouts

All or part of a roundabout should be closed whenever activity~~work~~ occurs on or adjacent to a roundabout if the required safety zones cannot be met.

On multiple lane roundabouts where the activity~~work~~ is confined to one lane, all entrances must be reduced to a single appropriate lane as for ordinary intersections and the respective lane on the roundabout closed except where required for exits.

Where entrances or exits are required to be closed the requirements of section C9 Road closures and detours must be followed.

~~C8.2.11~~C8.2.13 Passing lane/passing bay closure principles

Where activity~~work~~ occurs within a passing lane the following principles apply:

- If the start of the first taper is less than 600m from the start of the passing lane, the lane must be completely closed from its start point to the working space.
- If the start of the first taper is more than 600m from the start of the passing lane, a taper should be installed in advance of the working space as for a normal lane closure.
- If the passing lane extends for 600m or more beyond the closure then the lane should be opened. If there is less than 600m of passing lane to travel, the lane should remain closed.

Note: The figure of 600m is based on the distance required to safely pass another vehicle at 100km/h whilst allowing for a safe sight distance ahead. This distance can be reduced in consultation with the RCA based on local conditions where traffic is travelling much slower, such as on steep gradients.

A passing lane must have signs placed on both sides of the road for both directions of travel.

~~C8.2.12~~C8.2.14 Working next to a flexible barrier

For short-term static activit~~works~~ies the same approach will be adopted as for activity~~work~~ behind cones. This is to require a 1m lateral safety space between the wire-rope barrier and the working space.

For long-term activit~~works~~ies allowance must be made for barrier deflection as detailed by the manufacturer.

~~C8.2.12.1~~C8.2.14.1 Examples of how to set up for activity~~work~~ next to flexible barrier

2 + 2 lane road

- Close lane each side (usually a mobile closure).

2 + 1 lane road

- Close one of two lanes. ~~Work~~ Complete activity from the closed lane with a coned 1m lateral safety zone.
- A TSL and positive traffic management must be applied to the single lane.

1 + 1 lane road

- Place a centreline type static closure with a TSL and positive traffic

management.

~~C8.2.13~~C8.2.15 Construction or reconstruction of an existing road surface

~~C8.2.13.1~~C8.2.15.1 Use of MTC or portable traffic signals in a lane closure

For the purpose of construction or reconstruction of an existing road surface or during final trimming, where a single lane operation is required, the traffic must be separated by:

- cones or similar form of delineation, and
- using MTCs, portable traffic signals or priority give way signage - RP51/RP22 (RG-19.1) and RP52 (RG-20).

Where the traffic is not separated from the working space by delineation, for example during final trimming of the running surface prior to surfacing :

- the construction equipment must stop and activity~~work~~ cease while traffic is moving through the working space
- each work vehicle must be fitted with a TV4 (TW-34) Pass with Care sign, and
- at all times construction equipment must travel in the same direction of normal traffic.

Even though the machinery is stopped it may be necessary to provide a pilot vehicle to lead traffic through the worksite.

~~C8.2.14~~C8.2.16 Lane delineation during sealing and resealing activities on level LV, 1 and 2 roads

For chip sealing and resealing activities under MTC's control with an installed 30km/h TSL the following cone spacings may be used in the lane delineation (excludes tapers and lane shifts):

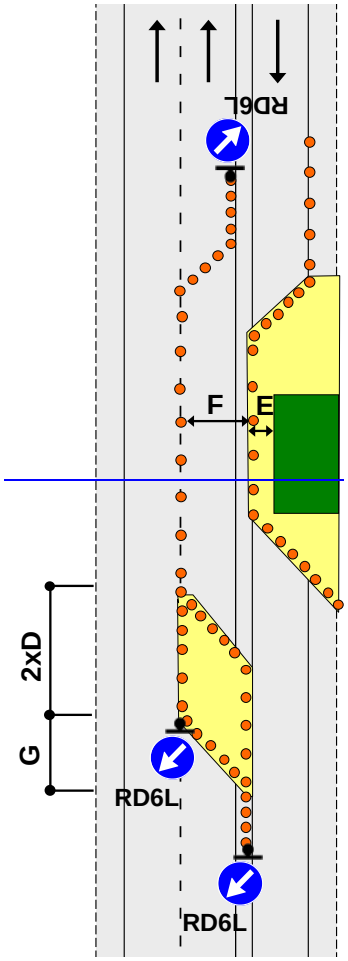
- 5m spacing can be increased to 10m spacing
- 10m spacing can be increased to 20m spacing.

Note: This above exemption applies only to full width chip sealing and resealing worksites. It does not apply to chip sealing of patch repairs. It does not apply to the cone spacing in tapers.

~~C8.2.15 Contraflow on multilane road~~

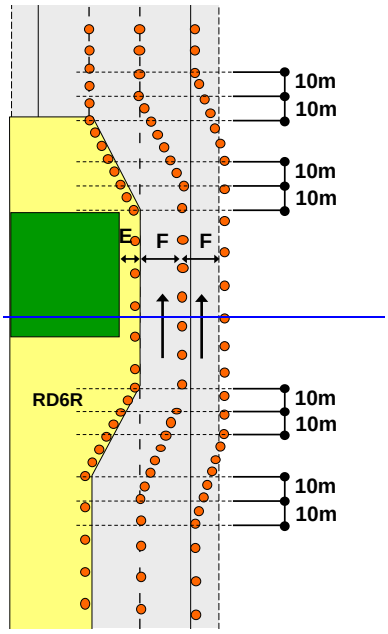
~~Where a contraflow is established on a multilane road, a longitudinal safety zone of 2xD is to be established to provide separation of vehicles.~~

~~See diagram below.~~

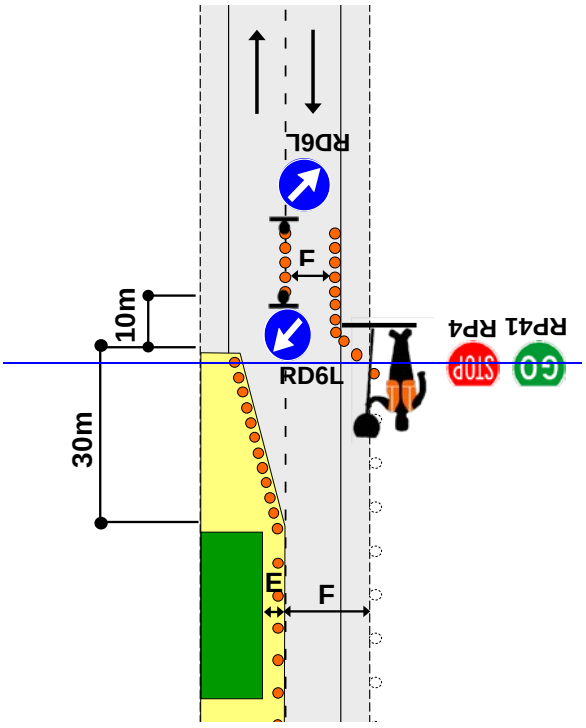


~~C8.2.16 Allowing heavy vehicles room to manoeuvre~~

~~Cones in a channel must be offset by a minimum of 10m where the direction changes to allow for heavy vehicles to manoeuvre without hitting the cones. See diagram below.~~



~~When a cone threshold is used, 10m must be left between the closure and the cone threshold to allow for heavy vehicles to manoeuvre. See diagram below.~~



C9 Road closures and detours

C9.1 Introduction

C9.1.1 General

A **road closure** is defined as the complete closure of all trafficable lanes to all road users. A total road closure should only be considered if there is no practical means of providing a safe worksite or by the scope of activity~~works~~ required.

A **detour** is a temporary route to guide road users around a worksite operation.

C9.2 Road closures

C9.2.1 Criteria for closing a road

In general there are four criteria for closing a road:

- **An emergency**
  For example, a traffic crash: closed immediately by emergency services and RCA notified immediately
- **Unsafe road conditions**
  For example, floods, slips, snow: closed immediately by the police, Civil Defence, etc in consultation with the RCA or engineer
- **Road works (with delays of more than 15 minutes)**
  Five (5) days notice is required, closed by the RCA
- **Cultural or sporting events**
  42 days notice is required, closed by the RCA.

All planned road closures and detours must be authorised in writing by the RCA.

C9.2.2 Emergency services may close a road

In the event of an emergency, emergency services may close a road to secure a worksite.

The RCA must be informed immediately if this type of situation arises. This is normally a requirement of the RCA's emergency strategy procedures.

C9.2.3 Notification

The RCA must notify other affected RCA's, the police, fire service, ambulance services and the New Zealand Automobile Association (AA) of any planned road closures or detours.

If the proposed detour route includes roads under the authority of another RCA, the RCA must ensure that the road has been approved for use as a detour route by the responsible RCA.

In addition to other required notification procedures, the following minimum advance notice must be provided prior to closing any length of road:

- **By the engineer to the RCA**
  Two (2) working days following receipt of TMP, in writing

- **By the contractor to the public**
  - five (5) working days before commencing activity~~work~~ where the activity is recognised as a road work activity, otherwise
  - 42 days before holding an event by advertisement in the appropriate daily newspaper. Refer to section E, appendix E Newspaper advertisement standard for a typical format, or
  - other specified media as detailed in the contract documents.

This notification will only be made after the RCA has agreed to the proposal to close the road. Any additional public notification requirements must be specified by the RCA. The media releases must be formatted to the approval of the RCA and approved as part of the proposed TMP procedure. Provision for these should be made in the contract documents (schedule of prices).

C9.2.4 Motorway Closures

In cases where the motorway is completely closed to traffic in one direction or both directions, the normal application of road closure signs, cones, barriers, fences or barricades at on and off ramps must be reinforced by a double line of cones at a normal warning distance from the working space.

TMA vehicles parked outside this inner cordon must be parked with their attenuators down and facing the normal direction of traffic. Vehicles inside the cordoned worksite are not subject to this requirement.

The double lines of cones must be either continuous or chicaned.

Examples of TMDs for motorway closures can be found in section H.

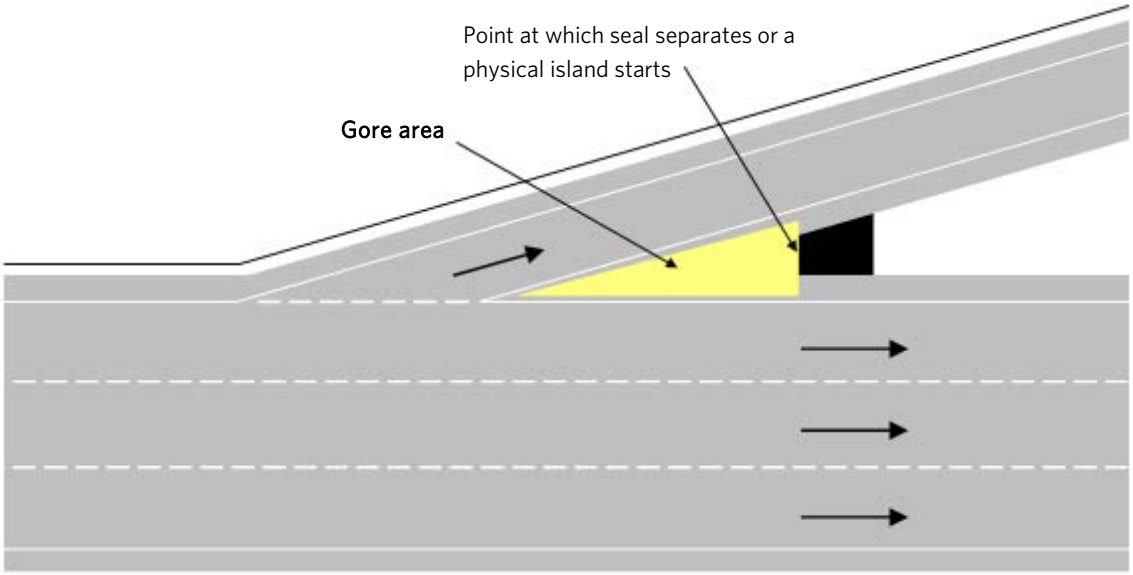
~~C9.2.4~~C9.2.5 Gore area and acceleration lane

A gore area is an area of seal at an on- or off-ramp located outside the edgelines of the ramp.

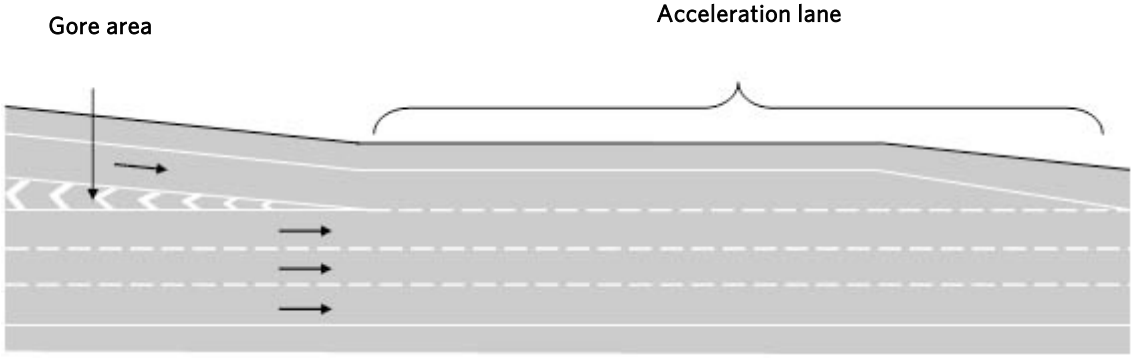
An acceleration lane is an area at an on-ramp which allows drivers to increase speed and safely merge with traffic.

When ~~working~~ undertaking activity in the gore area or acceleration lane on **level 2** and **level 3** roads, the ramp on which the activity~~work~~ is being carried out must be closed.

C9.2.5.1 Gore area



~~C9.2.4.2~~C9.2.5.2 Acceleration lane



C9.3 Detours

C9.3.1 Detour routes

All detour routes must be agreed in advance with the affected RCA(s), and full information provided to all emergency services.

Detours must provide a clearly delineated route for road users around the road closure.

All detour routes must be designed using roads that are capable of handling the volume and type of traffic that normally would use the closed road.

Consideration needs to be given to the following points:

- pavement (strength, surface)
- geometry (width, terrain, intersections)
- environment (dust noise)
- political (different RCAs, funding).

The length of a detour versus the expected time of closure and the location of the activity~~works~~ determines the practicality of installing a detour. It is acknowledged that in some remote areas of New Zealand practicable detours do not exist.

Signs used for all detours must comply with those shown in section B1 Signs.

Where a road closure affects more than one important destination, each destination should be individually signed with a different symbol on the signs, to ensure that road users can find their way to the correct destination.

This principle also applies to opposing traffic flows where both have been affected by the closure.

C9.3.2 Detour signs available for use

The TD3A (TW-21) Detour Ahead Follow Symbol sign is used for advance warning of a detour.

The TDA 1 to 6, TDB 1 to 6, TDC 1 to 6, TDD 1 to 6 (all TW-22) detour direction indicator signs guide and reassure road users along the route of a detour.

The sign ensures road users other than those following the detour are not misdirected.

The detour direction indicator signs are always mounted horizontally with the arrow either vertically upward, at 45 degrees upwards to the left or right, or horizontally to the left or right.

For multiple detours at one locality different symbols can be used for each detour. Recommended symbols include a square, circle and triangle. Symbols may be any colour provided that colour contrasts with the orange sign background.

C9.3.3 Detour signing principles

The principle of signing detour routes is to ensure that road users can safely and effectively navigate their way to their intended destinations without any confusion or excessive delay. The sign layout must not cause road users not affected by the closure to deviate from their intended route.

Sufficient signs must be erected along the detour route to direct road users to such a point where they can continue their journey using permanent route sign information. This usually involves directing road users back onto their original route of travel, at a point past the worksite.

C9.3.4 Detour signing

The TD3A (TW-21) Detour Ahead Follow Symbol sign gives advance warning of a detour.

A TLS (TW-7) 100m, 200m, 300m, 400m supplementary distance plate may be attached to this sign and the distance shown must be no greater than 400m, rounded to the nearest 100m.

The TD3A (TW-21) sign may only be used if an RD3 (RG-16) Road Closed sign is installed at the closure. The TD3A (TW-21) sign is used to direct road users to a suitable alternative route.

At subsequent changes of direction along the route TDA 1 to 6, TDB 1 to 6, TDC 1 to 6, TDD 1 to 6 (all TW-22) direction indicator signs should be used. Road users diverted from a closed section of road are advised to follow the specified symbol along the diversion route until the intended route is rejoined.

By employing this system, the entire detour route can be indicated ahead of time by the symbol chosen, which will be meaningless to road users who have not seen the sign at the start of the detour.

It is most important that a detour route is clearly and consistently signed throughout its length and that a TD5 (TW-23) Detour Ends sign is erected at the end of the detour. The purpose of this sign is to indicate to road users that the special temporary signing terminates at that point and that the permanent signing should now be followed.

Detour signs have black legends on orange backgrounds. This is to distinguish them from permanent directional signs and to attract the road user's attention in the unusual surroundings of the detour route.

In general the following principles apply to detour signage:

- The first TDA 1 to 6, TDB 1 to 6, TDC 1 to 6, TDD 1 to 6 (all TW-22) direction indicator sign should be located no more than 100m past the TD3A (TW-21) Detour Ahead Follow Symbol sign.
- The frequency of subsequent TDA 1 to 6, TDB 1 to 6, TDC 1 to 6, TDD 1 to 6 (all TW-22) signs will depend on the intersections encountered and route required. The road user must be confident that they are on the correct detour route at all times.

  On **level LV and level 1** roads marker arrows should not be placed more than 1km apart. On **level 2** and **level 3** roads they should be not more than 2km apart.
- TDA 1 to 6, TDB 1 to 6, TDC 1 to 6, TDD 1 to 6 (all TW-22) signs should always be placed well before multilane intersections to allow the road user to select the appropriate lane necessary, and at the intersection.
- TDA 1 to 6, TDB 1 to 6, TDC 1 to 6, TDD 1 to 6 (all TW-22) signs should also be placed at, or immediately after, important or complex intersections, irrespective of whether a change in direction was required, to confirm that the road user is on the correct detour route.

C10 Positive traffic management

C10.1 Introduction

C10.1.1 General

TSL signs alone will **not** ensure that vehicles will pass through a worksite at the correct speed.

Worksites need positive traffic management controls, in almost all circumstances, to reduce vehicle speeds to the TSL.

Positive traffic management is any additional measure/s that safely reduces traffic speed to the TSL. It does so by exerting a natural and acceptable restriction on traffic and highlights the reason for the need to slow down from the perspective of the driver.

Positive traffic management measures must be used when installing TSLs of:

- **less than 70km/h** in areas with permanent posted speed limits of **100km/h**, or
- **less than 50km/h** in areas with a permanent posted speed limit of **70** or **80km/h.**

Positive traffic management measures may also be applied where traffic is not complying with the TSL.

C10.1.2 Types of positive traffic management

The most effective means of reducing the speed of traffic through a worksite is to use **active** TTM measures, including, but not limited to:

- MTCs using stop/go paddles
- portable traffic signals, and
- pace vehicles (pilot).

Other means of effectively reducing the speed of traffic through a worksite are the use of **passive** TTM measures, these include, but are not limited to narrowing lane widths adjacent to the working space by the use of cones or other delineation devices to increase the phenomenon known as 'Side Friction'.

When approaching the MTC position, the cone threshold is an example of side friction.

- close spacing of delineation devices, and
- using flashing beacons, flares, or illuminated signs
- using temporary speed humps
- cone offset delineation (where cones are placed either side of a lane(s), the cones on one side are placed longitudinally offset from the other by a half cone spacing).

Different levels of positive traffic management will be necessary depending on the nature of the activity~~works~~, the **level** of road as specified by the RCA, sight distances and road alignment.

All positive traffic management measures must be detailed in the approved TMP.

C10.1.3 Control of two-way two-lane roads reduced to one lane

All two-way two-lane roads **reduced to one lane** require MTCs or portable traffic signals to manage traffic.

Special exemption may be granted by the RCA for roads carrying less than 1000vpd, in which case the TL9L/TL9S (TW-13) or TL9B (TW13.1) One Lane sign must be used in conjunction with RP51/RP22 (RG-19.1) Single Lane - Give Way and RP52 (RG-20) Single Lane - Priority signs.

The use of MTCs during the hours of darkness and during times of poor visibility should be avoided.

C10.2 Stop/go operations (manual traffic control)

C10.2.1 General

Stop /go operations must not be used where two-way traffic flow can be maintained past a worksite.

An MTC is a person employed by the contractor to manage traffic through a worksite. An MTC must receive a briefing and thorough training relating to the task from an STMS.

MTCs may be used for situations that include:

- stopping traffic to avoid a hazard
- allowing traffic from opposite directions to use one lane alternately (alternating flow)
- stopping all road traffic to allow construction traffic to cross or for blasting, or tree work
- slowing traffic where they need to travel very slowly, eg over new seal or in poor visibility, and
- giving road users verbal instructions or directions.

For long-term worksites, MTCs should be regarded as inappropriate.

The recommended device for traffic management at these worksites is portable traffic signals or barrier arm systems. A description of the use of portable traffic signals is in subsection C10.3 Portable traffic signals and their specifications and operational requirements are in section B5 Portable traffic signs.

C10.2.2 Equipment required

MTCs must use stop/go paddles except in unforeseen emergency situations when flag or hand signals may be used.

A cone threshold is installed to slow traffic and to separate the MTC position from passing vehicles. The minimum requirement is five cones placed at the taper spacing for the permanent speed. Where the speed exceeds 70km/h, this may be extended to 10 or more cones.

If the use of MTCs for activity at night ~~work~~ cannot be avoided, the MTCs must be on an area illuminated by artificial lighting. An illuminated red wand must be used in conjunction with the stop/go paddle. If there is insufficient light then MTCs must not be used.

Additional delineation devices should be used to assist the MTC provided they do not create a hazard to road users.

The wearing of clothing that obscures an MTC's view of approaching vehicles (excluding PPE) and the use of devices that reduce the awareness of an MTC to the sound of approaching vehicles are forbidden.

C10.2.3 MTC's layout essentials

A typical layout for an MTC operation can be found in layout example diagram FX.X (old E2.5). The principles for layout for MTC operations are set out below:

Provide advance warning of road works ahead by either T1A or T1B (TW-1) signs at each end of the worksite.

A T144 (TW-1B3) 30km/h ahead sign can also be used in conjunction with the T1 (TW-1) sign.

A TA2 (TW-15) sign (advance warning of MTC ahead) and the TA21 (TW-15.1) supplementary plate (Please Stop On Request) are placed at each end of the worksite.

Note: These signs must be covered or removed immediately MTC operations cease.

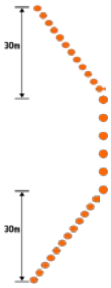
Place a TG1/RS1 (RG-4) 30km/h TSL gated (except for LV roads) across the road.

Note: If the permanent speed limit is 40km/h either 20km/h TSL may be used or the existing permanent speed limit of 40km/h may be retained. If the 40km/h permanent speed limit is retained,~~If using a 40km/h TSL,~~ positive traffic management must be used to compensate for the extra speed.

The TSL can be placed before the TA2/TA21 (TW-15.1) flagman stop on request sign if required.

Provide positive traffic management in the form of cones on the centreline and edgeline (5 cones placed at the taper spacing for the permanent speed).

A cone may be placed in front of the first vehicle once it has stopped. This prevents drive-offs.



Where tapers are required, these must be at least 30m.

An end taper is mandatory to prevent drivers who are queue jumping entering the end of the closure.

If the use of MTCs for activity at night ~~work~~ cannot be avoided, the MTCs must be on an area illuminated by artificial lighting.

If there is insufficient light then MTCs must not be used.

C10.2.4 Visibility of MTC

MTCs should take particular care to ensure they are:

- visible at all times and in particular at dawn or dusk, against low morning or evening sun, when in shadow on a sunny day, or in dusty conditions
- well lit at night
- not obstructing a road user's view of other signs and devices
- not hidden by other signs and devices.

C10.2.5 Mandatory 30km/h

Worksites controlled with MTCs must have a TSL of **30km/h**.

Note: If the permanent speed limit is 40km/h either 20km/h TSL may be used or the existing permanent speed limit of 40km/h may be retained. If ~~using a~~ the 40km/h permanent speed limit is retained ~~TSL~~, positive traffic management must be used to compensate for the extra speed.

Positive traffic management must be used to ensure speeds of approaching traffic are reduced.

C10.2.6 Location of MTC

MTCs must have a clear view of approaching road users for at least 120m.

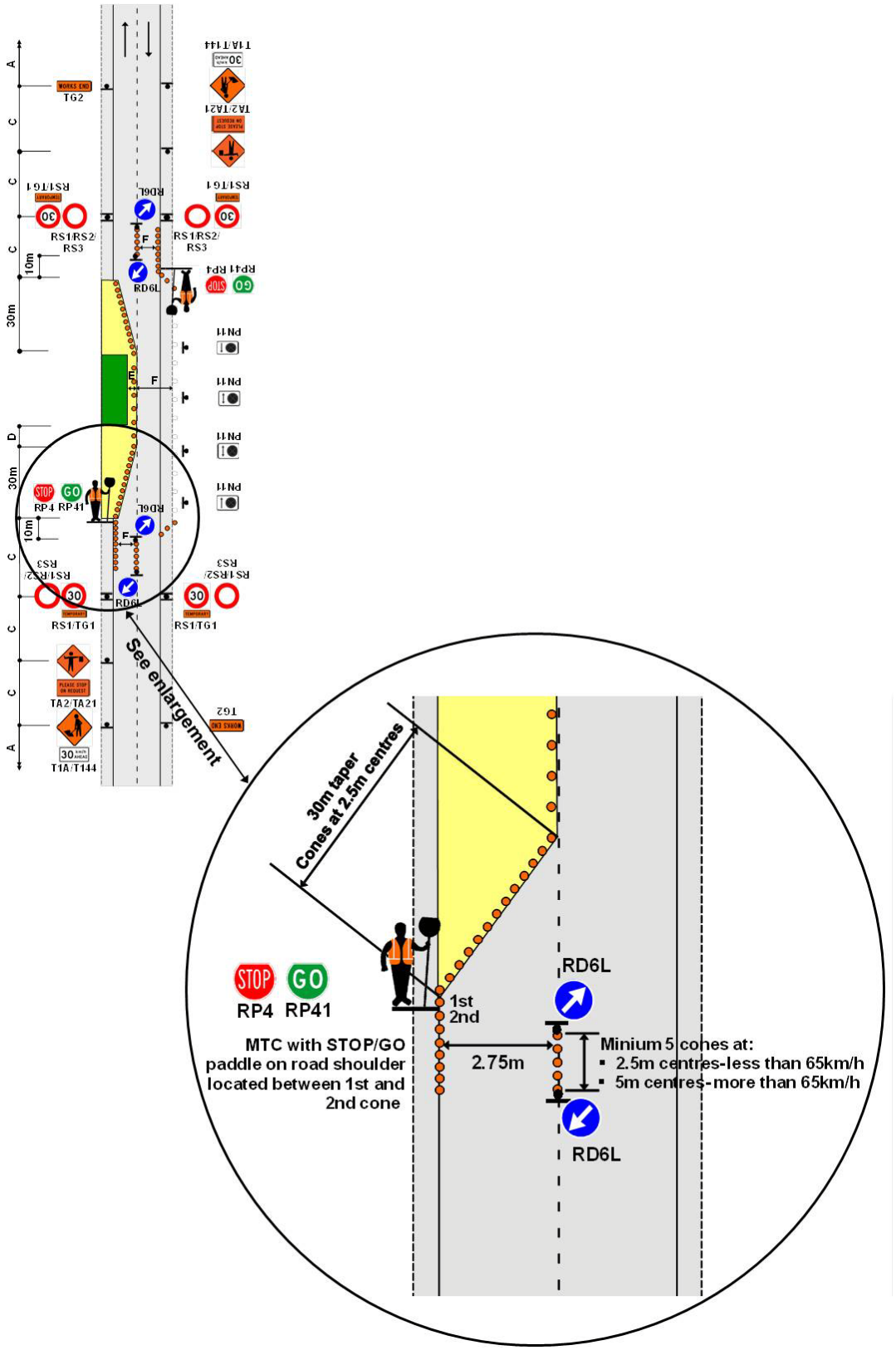
The STMS/TC must check that each MTC is stationed in the correct position.

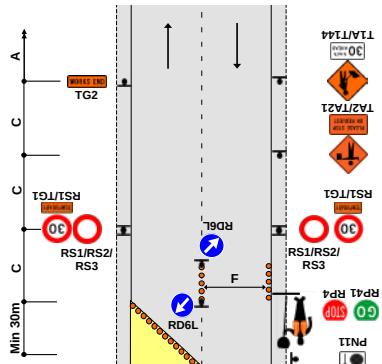
Side roads intersecting a worksite under the management of MTCs must also have an MTC at the intersection to help side road traffic pass safely through the worksite. An MTC must never control more than one approach.

It is the STMS/TC's responsibility to ensure the TA2 (TW-15) sign (Advance warning of MTC ahead) and the TA21 (TW-15.1) supplementary plate (Please Stop On Request) are set up before the MTCs begin operation and are taken away when the MTCs are no longer operating.

MTCs must stand facing oncoming traffic at the beginning of the cone taper on the left-hand shoulder or on the edge of the road and behind the cone threshold on the other lane.

Note: Under no circumstances may MTCs stand or operate unprotected in a live lane. If they need to communicate to a road user, they should do so from the shoulder once their vehicle has stopped.


See enlargement
30m taper
Cones at 2.5m centres
STOP
GO
RP4 RP41
1st
2nd
RD6L
2.75m
Minium 5 cones at:
2.5m centres-less than 65km/h
5m centres-more than 65km/h
MTC with STOP/GO paddle on road shoulder located between 1st and 2nd cone
RD6L



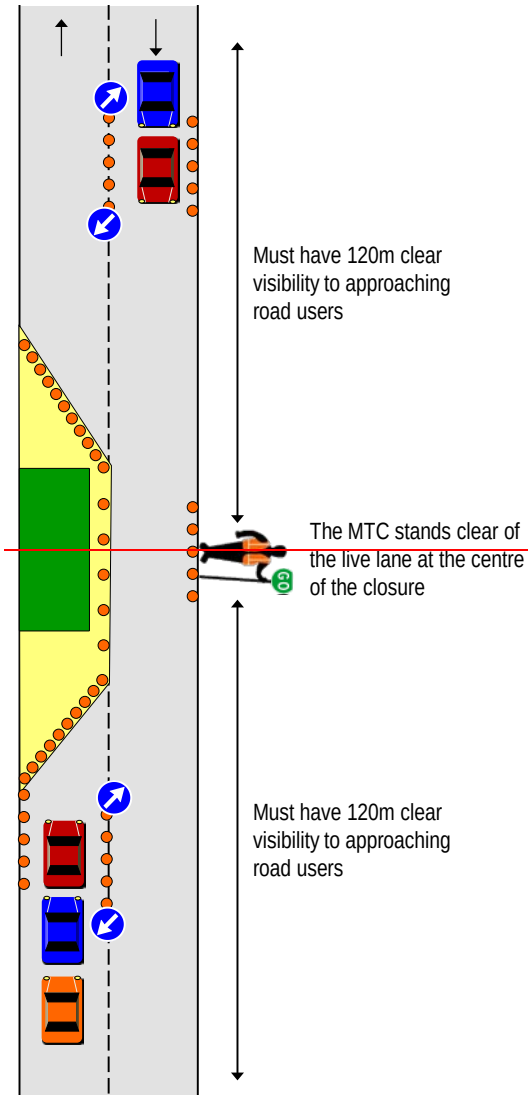
C10.2.7 Number of MTCs required

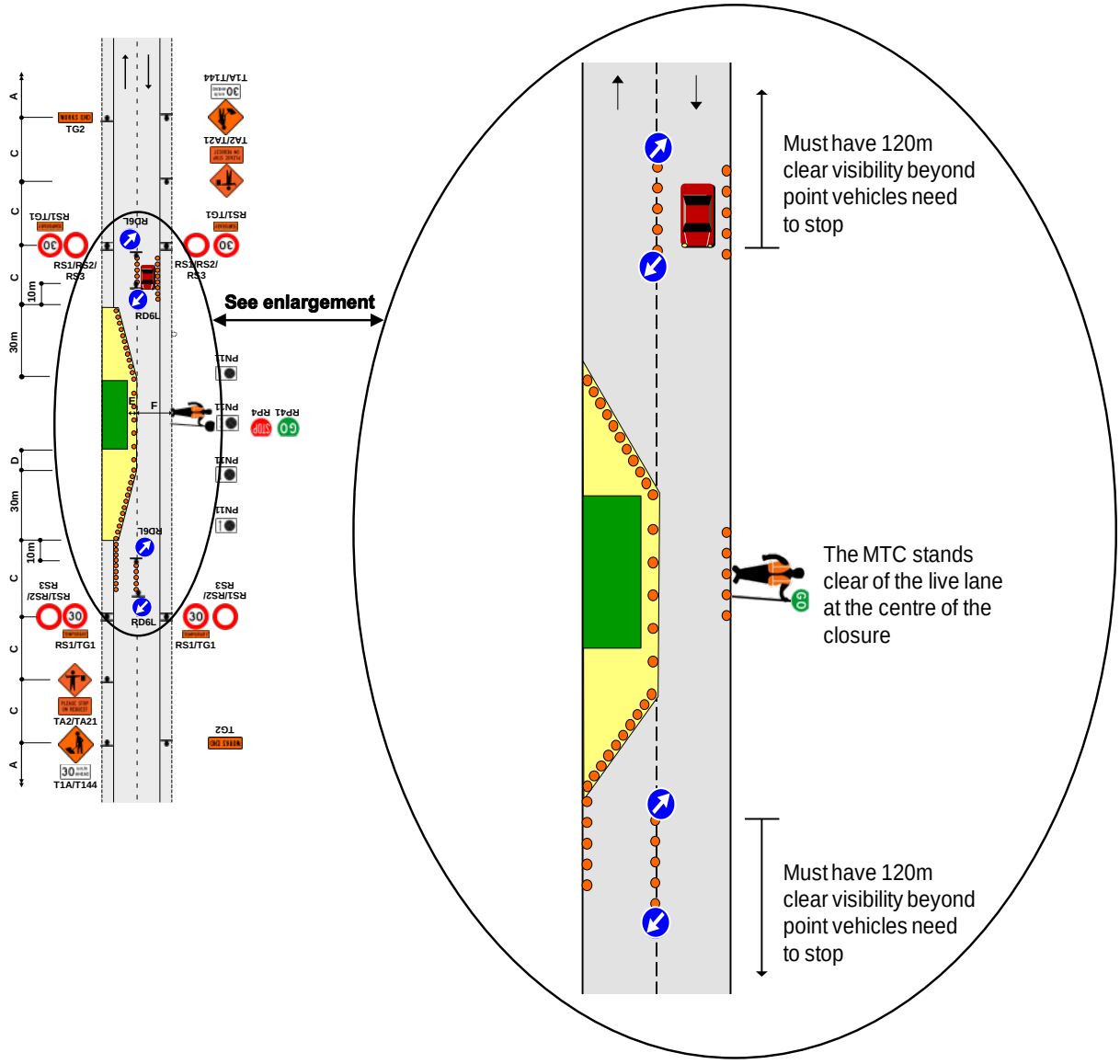
Normally two MTCs will be needed (one at each end of the worksite).

If the ~~section of closed lane~~working space is very short (less than 30m), on all level LV roads or level 1 roads under 1,000vpd and the MTC has at least 120m clear visibility from either direction beyond the point vehicles may need to stop, ~~to approaching road users from either direction,~~ then one MTC operating in the middle of the worksite may be used.

Single operators must be protected from working space and traffic hazards, and must not manage traffic unless it is safe to do so.

Work around intersections may require the use of three or more MTCs.




See enlargement
Must have 120m clear visibility beyond point vehicles need to stop
The MTC stands clear of the live lane at the centre of the closure
Must have 120m clear visibility beyond point vehicles need to stop

C10.2.8 Working with multiple MTCs

Where multiple MTCs are used they must:

- ensure that road users cannot see a conflicting message from the MTC at the opposite end of the worksite
- be in continuous radio contact with each other when they are not visible to each other.

C10.2.9 MTC procedures

MTCs should:

- maintain eye contact with the driver of the first approaching vehicle
- give definite and clear signals as shown below
- ensure they have an escape path ready in the event of a vehicle appearing not to stop
- be courteous at all times in dealing with the public, and
- maintain direct control of the stop/go paddle at all times (ie the MTC must not insert the paddle in a cone and walk away)
- remain in place until directed by the STMS/TC to leave, or be relieved by another worker.

To stop traffic

To stop traffic turn the paddle to stop and facing the traffic raise the other hand into the stop position with the palm towards the traffic.

To move traffic

To move traffic, turn sideways then turn the paddle to go and use the arm nearest the traffic to wave road users on with a sweeping movement across the body in the direction of travel.

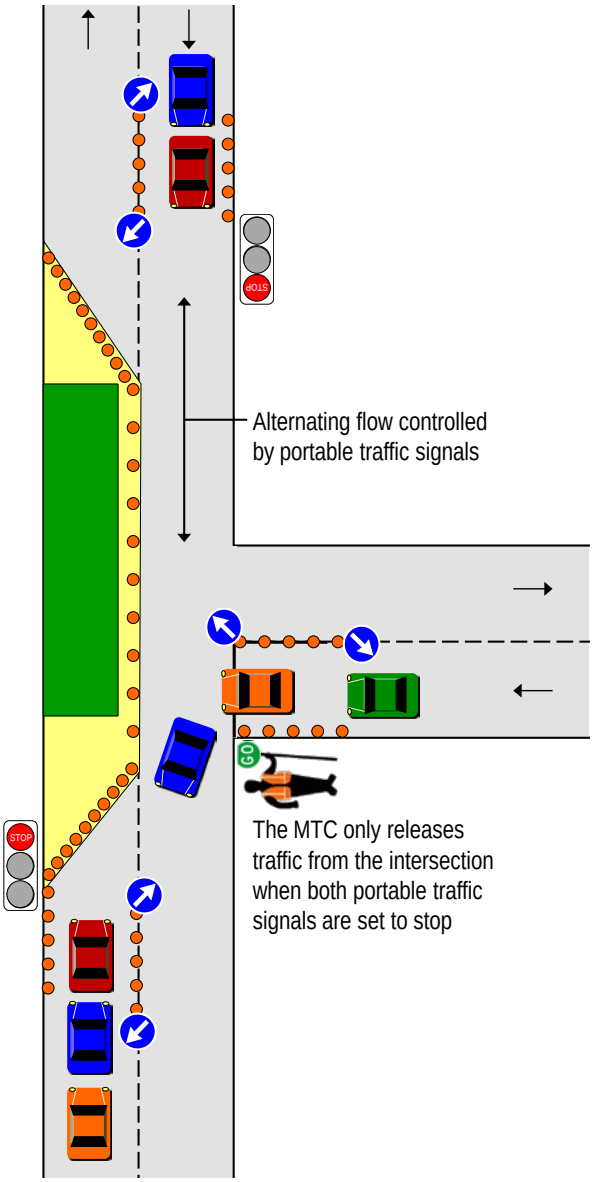
C10.3 Portable traffic signals

C10.3.1 General

Portable traffic signals must not be used where two-way traffic flow can be maintained past the closure.

Portable traffic signals are used for TTM where alternating traffic flows are required on temporary single lane, bidirectional roads.

Where portable traffic signals are used on a road where a side road(s) intersects the worksite, MTCs ~~must be used on side roads~~ may only be used on side roads if they have control of the signals and can ensure both signals are on stop before releasing traffic from the intersection. If they do not have this control then portable traffic signals must not be used.



Portable traffic signals are used to:

- allow traffic from opposite directions to use one lane alternately (alternating flow), and
- stop all traffic to allow construction traffic to cross or for blasting.

C10.3.2 Requirement

Portable traffic signals are intended for activities of relatively short duration.

Where activities continue for more than two months without the location of the working space changing, temporary fixed traffic signals must be installed.

Portable traffic signals must not be used where there is still sufficient road width to allow traffic to flow in both directions at once except where two-way traffic is controlled to allow construction vehicles to manoeuvre in and out of a working space.

C10.3.3 Use of compliant systems

Application to use portable traffic signals must be made on the TMP and the details of the system must be provided in the TMP (manufacturer and model description/number).

Refer to subsection B5.1.2 Certification of portable traffic signals for further details.

C10.3.4 Training

Where portable traffic signals are used, the operator must:

- be a qualified TC, and
- understand and be able to implement contingency plans.

C10.3.5 Mandatory 30km/h

Worksites controlled with portable traffic signals must have a TSL of 20 or 30km/h.

Positive traffic management will often be necessary to ensure that the speed of approaching traffic is reduced to that desired.

C10.3.6 Worksite layout

Traffic signals must be located on the left-hand side of each approach unless they would be more visible on the right.

The TA1 (TW-14) traffic signals temporary sign must be placed in advance of the signals and at the spacing specified in the layout distance tables for level LV, 1, 2 and 3 in section C2 Worksite layout.

Limit lines (temporary) must be installed at the appropriate locations when using portable traffic signals.

When it is impracticable to mark a limit line on the road surface the following signs must be used to emphasise where drivers are to stop:

- RP61 (RG-30) Stop On Red Signal mounted on the primary traffic signal pole immediately below the traffic signal head
- RP62 Stop Here On Red Signal mounted at the point where vehicles are required to stop.

Multiple lane approaches must be reduced to a single lane, using the appropriate taper lengths, at least 100m in advance of signals.

120m of unobstructed visibility must be provided to all traffic signals.

C10.3.7 Operational checks

Portable traffic signals must be regularly inspected to ensure:

- the settings are appropriate
- the alignment of the signal displays is correct
- the associated signs are intact and properly displayed
- detectors are functioning correctly
- there are no burnt out lamps and
- batteries are charged.

C10.3.8 Haul route crossing

C10.3.8.1 Traffic signal design

The general layout and installation of this type of traffic signal is similar to that of a normal signalised intersection. The design may, therefore, comply with the requirements of the Austroads *Guide to Traffic Management Part 10: Traffic Control and Communications Devices.*

A primary and secondary signal display is generally sufficient for the haul route approaches and tertiary displays may normally be omitted.

Notes detailing the method of signal operation must be shown on the intersection design drawings.

C10.3.8.2 Vehicle actuation

Vehicle actuation is the preferred mode of operation and if used, vehicle detection is provided on all approaches. A permanent recall is to be provided for the public road approaches, to ensure the signals return to green on the public road on the termination of the haul route phase and in the event of a detector failure on the public road.

If a detector ceases to function on the haul route, that phase may be manually controlled until the detector is repaired.

C10.3.8.3 Fixed-time operation

This mode of operation must not be used for the public road phase at haul route crossings. It may, however, be used for the haul route phase.

C10.3.8.4 Manual control

Local site conditions or the nature of the haul route traffic may preclude the use of normal vehicle detectors. Microwave detectors must not be used where worksite operations in the vicinity of the crossing may generate spurious demands. Also, very slow moving vehicles may not activate microwave detectors. Under these conditions and where, in the opinion of the RCA, vehicle actuation is not practicable, manual control may be used.

For manual control it is essential that the operator can clearly observe traffic conditions on all approaches and that they ensure delays to the traffic on the public road are minimised. The signals must also rest in green for the public road phase when there is no demand for the haul route phase.

C10.3.8.5 Partial manual control

Partial manual control is preferred to full manual control. Under this system the public road approaches are controlled by a detection system and demands for the haul route approaches are made manually. The haul route phase is also extended by a manual operation, up to the maximum green time set for that phase.

C10.3.9 Signal-controlled site access

C10.3.9.1 Leaving a signal-controlled site access

Vehicles leaving a site through a red signal at a signal-controlled intersection will be deemed to be entering the public road illegally.

Where vehicles may be required to leave such a site and the intersection operates under manual or partial manual control, and there are no manual controllers on site, an alternative exit point must be provided. This point must be located well away from the signal-controlled intersection.

C10.4 Pace vehicles (pilot) method

C10.4.1 Use of pace vehicles (pilot)

The pace vehicle (pilot) method is very useful in restricting vehicle speeds through a long worksite.

This method involves a pilot car leading a queue of vehicles through the worksite. MTCs are positioned at each end of the closure to stop traffic until a pilot car is available.

The TV1 (TW-25) Pilot Car Follow Me sign is mounted on the rear, or the roof, of the pilot car.

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C10.5 Temporary speed humps

C10.5.1 Use of compliant systems

A register of compliant systems is available on the NZ Transport Agency's website. Refer to subsection B13.1.2 Approval for more details about compliant systems.

C10.5.2 Installation of speed hump

The use of speed humps must be approved by the RCA.

A temporary speed hump must only be used at attended worksites with other positive traffic management measures in place.

The speed hump must be positioned a minimum of a sign spacing after a 30km/h TSL.

Note: If the permanent speed limit is 40km/h either 20km/h TSL may be used or the existing permanent speed limit of 40km/h may be retained. If the 40km/h permanent speed limit is retained,~~If using a 40km/h TSL,~~ positive traffic management must be used to compensate for the extra speed.

For example, within a permanent speed limit of 100km/h the speed hump must be positioned at least 75m after the 30km/h sign.

Both the edgeline and centreline must be coned from the 30km/h TSL to the speed hump. It is essential to give adequate warning to motorists.

If a cycle lane exists it must **not** be closed by the speed hump.

The recommended method of installation is to set up the positive traffic control first and then, using MTC to protect the workers, roll out the speed hump and leave in position.

C11 Temporary traffic management (TTM) installation, management and removal

C11.1 Introduction

C11.1.1 General

Traffic management measures must be installed, maintained and removed in a planned and safe manner consistent with this section or as detailed in the approved TMP.

The installation of traffic management signs and devices must be undertaken so that it:

- does not conflict with information on any warning signs already erected
- does not create an unavoidable hazard for road users or workers, and
- is efficient, logical and quickly isolates the working space from road users.

Short-term static worksites will usually require a mobile operation to install and remove them.

Long-term static worksites on **level 2** and **level 3** roads must use a short-term static closure to install and remove barrier systems.

On state highways and **level 2** and **level 3** roads, the TMP must specify the different stages of operation (eg including the mobile operation to install the static closure).

Prior to commencing, the STMS must check and review the approved TMP, the site and the proposed activity~~work~~ to ensure they are complementary and are appropriate. The STMS must check the road environment especially including the on the day traffic flows to ascertain that they are at an appropriate level for the TTM intended.

C11.2 Set-up and removal of worksite

C11.2.1 Order of worksite establishment

On single direction carriageways signs must be deployed on the left side of the road first, and then on the right hand side of the road, if required.

On bi directional carriageways, signs should be erected by travelling around the road network in a clockwise direction taking in each side road as they are passed. In this way all turns in and out will be to the left which is easier and safer:

a. The first sign erected must be the advance warning sign.

b. Remaining signs are placed in order from the advance warning sign until the works end sign is reached. The vehicle then makes a loop on a single direction carriageway or simply turns around on a bidirectional carriageway to make the next run. This process is continued until the sign network is complete.

c. Tapers and delineation devices must only be placed once all signs have been installed.

d. Before any construction equipment or materials are brought onto the worksite a drive through check of the worksite must be made in all directions including all side roads. This check must confirm that the worksite is:

   - safe
   - to the minimum standard shown in the TMP and that:
     - the restriction to traffic flow is reasonable
     - the signs and delineation devices give clear messages to road users, and
     - the signs and delineation devices are securely erected and will remain in their correct position under the expected traffic volumes and weather conditions.

C11.2.2 Removing the worksite

The removal of TTM measures must be in the reverse order of establishment, ie reverse order for removal as per (c), (b), (a).

C11.2.3 Installation requirements for signs

Signs must comply with the requirements of section B1 Signs and the operational requirements of section C3 Signs and worksite zones.

C11.2.4 Installing signs on level LV and level 1 roads

Vehicles used to install TTM equipment on level LV and level 1 roads must have:

- amber flashing beacon(s) visible to all approaching traffic
- signs, either T1A (TW-1) and RD6R/L (RG-17/34), or TV4 and RD6L/R (TW-34).~~.~~

If workers are not protected by another work vehicle then TTM equipment must be installed from the side of the work vehicle.

Under no circumstances should signs be erected or any activity~~work~~ carried out by personnel behind a work vehicle exposed to oncoming traffic.

Signs are to be installed so that:

- the nearest edge is at least 500mm clear of the travelled path of vehicles
- the reflective face of the sign is angled at approximately 95 degrees from the road centreline so that the light is reflected away from the road user
- they are clearly visible to oncoming road users, and
- they are well ballasted and stable in reasonably expected weather and traffic conditions.

C11.2.5 Installing signs on level 2 and 3 roads

Before installing and removing signs on level 2 and level 3 roads short-term static closures must be implemented using mobile operations.

These mobile operations use advance warning, shadow vehicles and work vehicles.

While maintaining the full complement of vehicles, the roles of the vehicles may be rotated, providing that there are no workers on the back of the advance warning or shadow vehicles.

Signs are to be installed so that:

- the nearest edge is at least 1250mm clear of the travelled path of vehicles
- the reflective face of the sign is angled at approximately 95 degrees from the road centreline so that the light is reflected away from the road user
- they are clearly visible to oncoming road users, and
- they are well ballasted and stable in reasonably expected weather and traffic conditions.

C11.2.6 Installation of channelling and delineation devices

All equipment used must comply with the requirements of section B2 Delineation devices.

The spacing of delineation devices should be to the requirements of the layout distance tables for level LV, 1, 2 and 3 roads in section C2 Worksite layout.

Delineation devices are to be installed in straight lines or smooth curves, to give clear direction to the road users.

On **level LV** and level **1** roads delineation devices can be installed and removed by personnel on foot.

~~Before installing and removing delineation devices on **level 2** and **level 3** roads short-term static closures must be installed using mobile operations~~A mobile operation must be used when installing or removing delineation devices at a static closure on level 2 and 3 roads. This must be described in the TMP.

C11.2.7 Installation requirements for barrier systems

Barrier systems are used to provide continuous protection for the working space.

Acceptable forms of barrier system must comply with the design requirements of section B12 Barrier systems.

The layout must conform to the approved TMP and the barrier system must be installed in accordance with the manufacturer's recommendations.

During installation, modification and removal of the barrier system, exposure of unprotected ends must be minimised and, where necessary, protection must be provided.

Long-term static worksites on level 2 and level 3 roads must use a short-term static closure to install and remove barrier systems.

C11.2.8 Redundant TTM equipment

All redundant TTM equipment must be removed from the site or placed in a safe secure location.

Redundant equipment is defined as that TTM equipment not in current use for TTM. This includes TTM equipment not required when the site is left unattended.

Redundant TTM signs, sign supports, sign bases and delineators, may be stored on site provided that:

- the equipment does not remain on-site and unused for a period greater than 48 hours
- the equipment is stored in a safe location where it will not pose a hazard to any person or property
- STMS's identify and appropriately manage the site specific hazards as they apply to this matter
- the equipment must not be stored or placed on an open footpath or cycle way
- the equipment must be stored at least 5m from edge line where no footpath exists or, where one exists, in the back berm area (i.e. between footpath and boundary)

Redundant TTM equipment must not be left standing nor deployed.

~~C11.2.8~~C11.2.9 Minimising the effect of ghost markings

Care must be taken to ensure that old or temporary markings are adequately erased to avoid misleading road-users with ghost markings during wet and low-light conditions.

The standard for line removal is detailed in the NZ Transport Agency's *State highway maintenance contract proforma manual* (SM032). This references the New Zealand Roadmarkers Federation's *Line removal guide* which provides detailed advice on this subject.

The SMO32 states:

Using the principles outlined in the NZRF Line Removal Guide, the Contractor must remove all:

(a) Paint that has been applied outside the specified tolerances, including all run-ins and runouts

(b) If instructed by the Engineer, existing markings so:

- *A satisfactory level of removal is achieved in accordance with the NZRF Line Removal Guide. Only sufficient marking material shall be removed so that it cannot be distinguished from the driver's eye height (nominal 1.2 m). (Note: it is acceptable for some marking material to remain in the interstices of the pavement surface)*
- *The final surface texture is similar to the surrounding pavement.*

Blacking out markings (using a paint marking system) prior to a permanent removal method may be used (with the Engineer's approval) as a temporary measure until permanent removal can be completed.

When required the Contractor shall mill existing profiled markings prior to remarking. It may be desirable to leave a thin layer of old marking material on the road prior to remarking so as not to damage the pavement surfacing.

C11.3 Management of the worksite

C11.3.1 Monitoring frequency

For details of the monitoring frequency for worksites refer to subsection C19.5.1 Monitoring frequency for TTM measures.

C12 Unattended worksites and activity at night ~~work~~

C12.1 Introduction

C12.1.1 General

Yearly studies by the NZ Transport Agency on injury crashes at road works worksites between 2005 and 2010 show that approximately 85 percent of crashes resulting in injury occur when the worksite is unattended.

Unattended layouts must be carefully considered and planned.

C12.2 Unattended worksites

C12.2.1 Unattended worksites

The layout of the unattended worksite must be covered in the approved TMP.

Unattended worksites must be:

- safe
- secure, and
- stable.

All equipment and materials must be positioned well clear of the live lanes and adequate protection for road users must be maintained at all times refer to subsection C14.1.4 Parking and storage of vehicles, plant and materials.

Where pathways exist and there is insufficient lighting to highlight the approach to any hazards on the path, then amber flashing warning lamps must be installed.

C12.3 Excavations

C12.3.1 Legal requirement for excavations

According to the Health and Safety in Employment Regulation 1995, regulation 25:

Every employer must take all practicable steps to ensure, where any excavation is:

(a) readily accessible to any person; and

(b) likely to collect or retain water of such a depth as to constitute a danger to any person, –

– that

(c) any such excavation is covered or fenced, when no employee is in the immediate vicinity to prevent access to it by any person; and

(d) any such excavation created in the course of the work is covered, fenced or filled at the completion of the work.

C12.3.2 Excavations left unattended

Any excavation capable of holding water must be protected in terms of the Health and Safety in Employment Regulation 1995, regulation 25 (Excavations of Hazardous Depth).

Excavations greater than 1.5m deep must comply with regulation 24: Excavations with a face more than 1.5m high.

Further information may be found in the *Approved code of practice for safety in excavations and shafts for foundations* (1995) published by the Ministry of Business, Innovation and Employment (Labour).

Any excavation left unattended must either be:

- fully enclosed by a safety fence
- plated, or
- backfilled.

In that order of preference, to prevent pedestrians and cyclists from falling into them.

Barricades, cones, plastic mesh netting not supported by a solid frame and hurdles are **not** sufficient to adequately protect road users from excavations.

Guideline specifications for suitable safety fences to protect excavations are detailed in section B6 Safety fences.

As part of preparing the worksite to be left unattended, also consider the following actions:

- reduce the size of the worksite as much as possible
- if TSLs have been installed, consider whether these are still required or whether the TSL should be changed (remember that changes to the TSL must be approved)
- sweep any loose material from the sealed road surface
- check that all signs are ballasted and positioned correctly
- check that all delineation devices are clean and positioned correctly.

If the worksite is to be left unattended overnight, consider the following additional actions:

- place amber flashing lamps on each corner of any barricade/fence, to help make the worksite and hazard more identifiable
- ensure there is enough guidance for road users as they pass by or through the worksite – add additional cones if required (for example if the closure is on a corner or over a hill, extend the cones further towards the oncoming traffic to provide more guidance).

C12.4 Activity at nightt work

C12.4.1 General

C12.4.2

Undertaking activity at night work is effective in reducing delays to traffic because traffic volumes are lighter than during most daylight hours.

ActivityWork at night must be subject to careful additional planning and inspection.

C12.4.3 Additional considerations

When planning night-time traffic management measures the STMS will need to consider that:

- traffic density will be less and hence traffic speed may increase
- road user's visibility is reduced
- road users awareness may be reduced for a variety of reasons
- positive traffic management measures may be different
- additional lighting for working spaces, safety zones, MTCs, pedestrian and cycle lane detours, and for mobile working plant is required. These should always be chosen and mounted so that they direct light downward. **Light sources that produce glare that could dazzle road users are not permitted**, and
- MTCs should use illuminated wands, ideally 'LED' type or similar luminanceUse of illuminated wands is optional and may only be used when overhead lighting for MTCs is provided.

C12.4.4 Traffic signs

On all **levels** the first temporary warning sign encountered by road users must have a retro reflective fluorescent orange material background.

All signs must have a delineation device placed at the base of each sign.

The delineation device must be placed on the side of the sign to which road users are expected to pass.

C12.4.5 Delineation devices

On **all levels** of road, suitable reflectorised delineation devices parallel to the direction of traffic must be installed.

For barricades and fences the recommended reflectorised delineation device is the 200mm x 150mm retro-reflective chevron as detailed in subsection B12.1.4 Channelling traffic. These devices should be installed at 10m spacing and at every corner.

C12.4.6 Amber flashing warning lamps

On level LV and level 1 roads where there is a hazard on a footpath or cycle lane, amber flashing warning lamps may be placed on any barricades and fences.

A lamp may also be placed on each corner of the barricade/fence, to help make the worksite and hazard more identifiable.

If there is insufficient lighting to highlight the approach pathway and any hazards on the path, then amber flashing warning lamps must be installed.

Amber flashing warning lamps must be capable of maintaining their flashing mode throughout the night while the worksite is unattended.

Amber flashing warning lamps must be clearly visible from a height of 1.1m to 2.4m over a distance ranging from 0m to 600m from the light.

Amber flashing warning lamps may also be used as part of the advance warning for the worksite.

When used in this manner they must be placed so that the nearest edge is at least 500mm clear of the travelled path of vehicles for level LV and level 1 roads, and at least 1250mm clear of the travelled path of vehicles for level 2 and 3 roads.

Note: Whatever is holding the lamp must be frangible.

Long length worksites delineated entirely with amber flashing lamps may confuse approaching road users. Delineation with reflective type devices reduces confusion for long worksites.

C12.4.7 Artificial lighting

Artificial overhead lighting must be used for the safety of personnel and road users at all attended night time worksites. The contractor must indicate in the TMP the type of lighting to be used.

Lighting is to be used to illuminate:

- the working space, and
- MTCs where it has not been possible to avoid their use.

Lighting must not create a disabling glare for road users. A drive through the worksite from all approaches immediately after the lighting is installed to check for glare must be undertaken by the STMS/TC.

Pedestrian and cyclist detours or temporary paths must be adequately lit, especially when the worksite is unattended.

C13 Pedestrians and cyclists

C13.1 Introduction

C13.1.1 General

Where ~~work~~ activities affect pedestrians or cyclists, the TTM must ensure that:

- pedestrians or cyclists are not led into direct conflict with the ~~work~~ operation or traffic moving through or around the worksite
- if cyclists or pedestrians are directed into live lanes they should be adequately protected from traffic by delineation and/or barriers and suitable warning signs
- safe and impediment free temporary paths are provided where footpaths and/or marked cycle lanes are blocked by the activity.

C13.2 Pedestrian requirements

C13.2.1 General

Pedestrians, including those with impaired vision or wheelchair users must be considered as part of the design, preparation, approval and implementation of the TMP.

C13.2.2 Footpath widths

Set out below are the minimum footpath widths.

Location	Minimum width	Comments
Residential/Rural	0.9m	Where the length of the working space exceeds 20m, these widths may have to be increased so pedestrians do not have to wait to pass.
Suburban centre	1.2m	
Central business district (CBD) and commercial zones. Commercial zones include shops, schools, visually impaired routes, aged persons homes, hospitals, tourist attractions, bus stops, libraries.	2.0m	

C13.2.3 Alternative routes

Where the activity impacts a footpath and minimum footpath widths cannot be maintained, alternative routes with a firm smooth surface and no trip hazards are to be provided in the following order of preference:

1. onside of road reserve away from the carriageway, or
2. between the working space and carriageway (but not into the live lane), or
3. into the carriageway (either in a parking lane or a suitably delineated and protected section of the existing traffic lane~~but not into the live lane~~)
4. across the carriageway to a footpath on the opposite side with delineation of the crossing points and kerb ramps to assist mobility vehicles and pushchairs

   Note: This option is strongly discouraged and is not to be used if the above options are feasible~~.~~ (only use where there is a pedestrian or a signalised crossing **or** on a level LV or level 1 road with a speed of less than 65km/h).
5. use footpath controllers to guide pedestrians around the operation

   Note: Only use this method when there is no alternative temporary footpath safely available.

C13.2.4 Footpath controller

Where there is no alternative footpath safely available, sufficient footpath controllers are to be provided to guide pedestrians through the activity.~~around the operation~~ A footpath controller may be used to manage pedestrians, cyclists or other road users, and road workers entering and leaving working spaces, including people involved in events.

They can also be used to guide pedestrians where appropriate footpath widths cannot be achieved.

Note: Footpath controller's duties do not include duties of an MTC. A footpath controller is suitable for footpath duties alongside a level LV or level ~~-~~1 road but must have a minimum of a level 1 TC qualification for level 2 footpath controller duties.

RCAs may require footpath controllers to be used if there are known pockets of elderly or children in the area, that is, if activity~~works~~ is~~are~~ near rest homes or schools.

The footpath controller must be briefed by the STMS/TC.

The briefing must cover:

- all duties required of the person
- a record for any incidents observed
- use of two way radios where these are necessary, and
- any hazards on site and mitigation methods.

The briefing is to be recorded and both parties are to sign to the effect that the briefing has been delivered satisfactorily and fully understood.

The person selected for this duty must be someone with satisfactory people skills, sufficient competency for the task described and a mature attitude.

C13.2.5 Protecting pedestrians from the working space

If pedestrians could otherwise gain access to the working space then the contractor must protect pedestrians by installing:

Option	When used
Safety fences	Long-term or unattended worksites where there are hazards remaining for example such as >50mm excavations or exposed cables.
Cones connected with cone bars	Attended worksites and only for a short period of time. **Note:** Cone bars are not recommended where heavy equipment (eg a digger) is being used. A safety fence is preferred in these cases.

C13.2.6 Footpath diverted into carriageway

If the footpath is to be diverted into the carriageway then the traffic side of the footpath must be delineated from the traffic by either:

Option	When used	Lateral safety zone required with delineation
Barriers	Long-term worksites.	0.5m
Safety fences	• Long-term worksites. • Any unattended worksites. • Attended worksites on level 2 roads and state highways.	1m
Cones connected with cone bars	Attended worksites on level LV and level 1 roads (except state highways) and only for a short period of time.	1m

C13.2.7 Ramps

Kerb ramps and any other footway ramps must meet minimum footpath width requirements and be not steeper than one vertical in eight horizontal.

C13.2.8 Pedestrian crossings

Where a pedestrian crossing becomes unusable or where the zebra road markings are removed or obliterated, the belisha beacons, discs and any other indication of the crossing must be covered and barricades or safety fences placed across all the pedestrian access to the crossing (on both sides of road).

An alternative pedestrian crossing system must be provided particularly when the crossing serves elderly pedestrians or a school.

C13.2.9 Covered footpaths

A covered footpath must be provided where falling debris is a concern, refer to subsection C6.2.4 Overhead safety zones.

C13.2.10 Lighting

Temporary paths and covered footpaths must be adequately illuminated at night, refer to subsection C12.4.7 Artificial lighting.

This may mean that artificial lighting to the appropriate level required by Australian and New Zealand Standard 1158.1.1:1997 *Road lighting - Vehicular traffic (Category V) lighting - Performance and installation design requirements* (AS/NZS 1158.1.1:1997) has to be installed.

C13.2.11 Signage for temporary paths and detours

Suitable detours and their applicable signs are:

Pedestrian crossing closed

TU1 (TW-30) Crossing Closed Please Use Alternative Crossing.

Note: Whenever this sign is installed, there must be an alternative crossing available.

Footpath closed and pedestrians are to be directed across the road to an alternative footpath

TU2 (TW-31) - Footpath Closed Please Use Other Side.

Pedestrians must not be required to cross more than 2 lanes without a central pedestrian refuge.

Note: This sign can only be erected on level LV and level 1 roads with a posted speed limit of less than 65km/h. Care must be taken when using this method above 50km/h.

When using this sign it must be shown in the TMP with sight distances to the sign. Minimum sight distances to the sign are:

- 75m at 50km/h
- 100m at 60km/h

Directional arrows for temporary footpaths adjacent to the working space

TU31 to TU36 (TW-33) Pedestrian Direction sign.

C13.3 Cyclist requirements

C13.3.1 General

Cyclists must be accommodated in the TMP.

C13.3.2 Temporary paths and detours

Wherever cycle lanes are installed on an existing road they must be replaced with alternative lanes if the normal cycle lane is affected by the worksite activity.

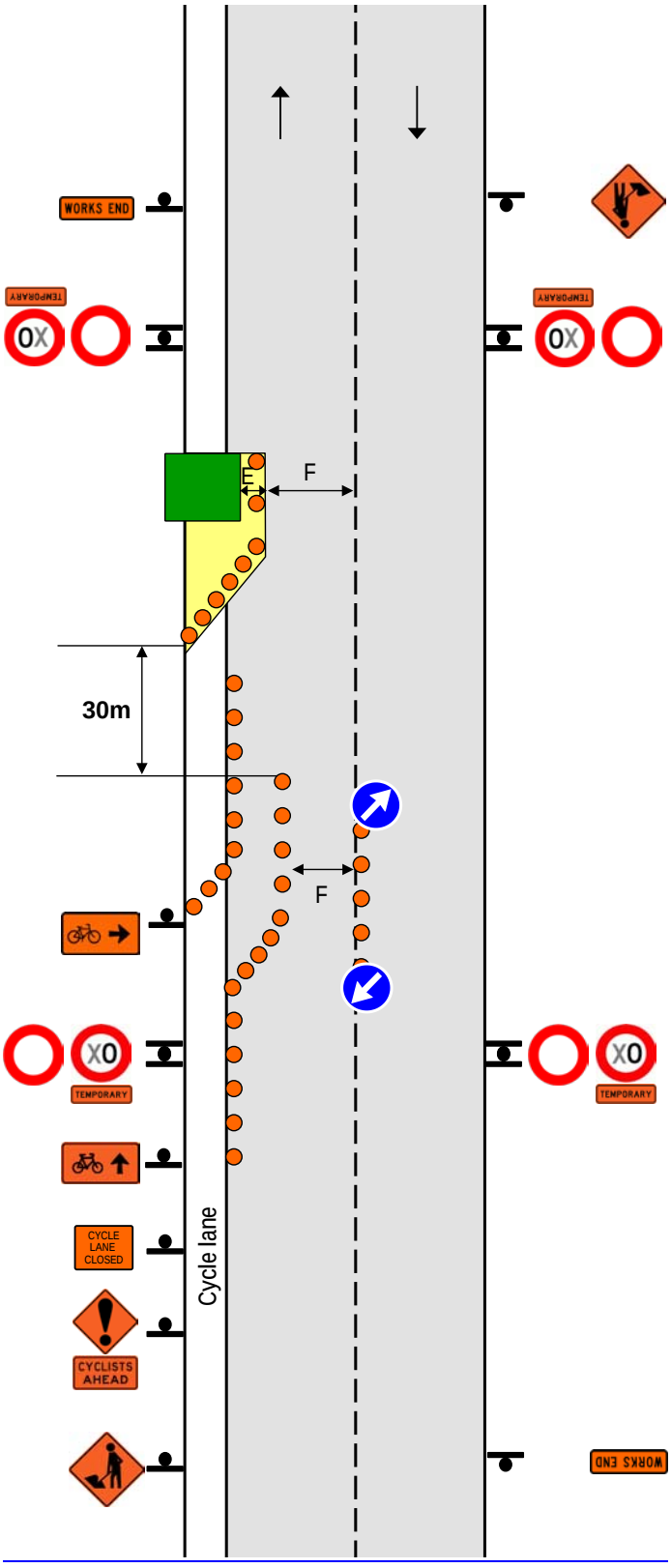
Where because of road environment constraints there is insufficient width to fit a replacement cycle lane while maintaining existing traffic lanes, a contractor may consider merging the cyclists into the traffic lane. To use this option the contractor must have TMP approval and must provide a threshold treatment including a TSL to enable the cyclists to merge into the traffic lane.

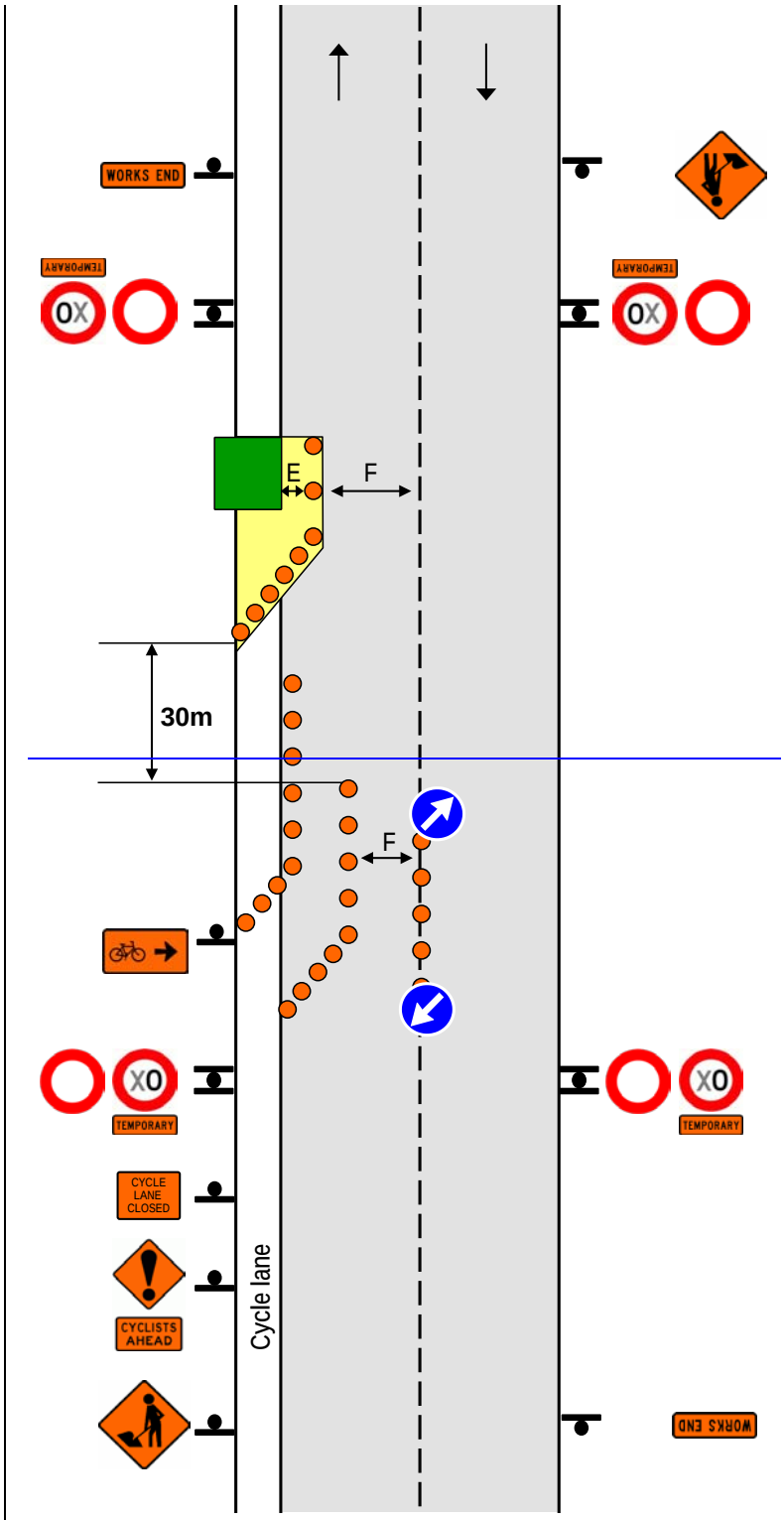
A Cycle Lane Closed sign must be used to alert cyclist to the merge ahead. A T230 (TW-2.16.1) Cyclists Ahead sign followed by a 30km/h TSL must be used in advance of the merge to alert motorists.

The merge must be coned.

See the diagram on the next page.

Example where cycle lane is merged with traffic lane.


WORKS END
TEMPORARY
F
F
30m
F
TEMPORARY
CYCLE LANE CLOSED
CYCLISTS AHEAD
Cycle lane
WORKS END


WORKS END
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TEMPORARY
CYCLE LANE CLOSED
CYCLISTS AHEAD
Cycle lane
WORKS END

C13.3.3 Cycle lane and shared footpath/cycle way widths

Set out below are the minimum temporary cycle lane widths.

Type of lane	Speed	Minimum Width (m)
Single direction cycle lane	Speed limit does not exceed 50km/h	1.0m *
Single direction cycle lane	Speed limit exceeds 50km/h	1.5m
Two-way cycle lane	Any speed	2.0m
Shared footpath and cycle way	Any speed	2.2m #

***Note:** A minimum lane width of 1.5m is required if the temporary cycle lane is uphill as riders tend to pump their cycles from side to side as they climb the hill.

#Note: Where a shared footpath and cycle way is reduced to less than 2.2m wide, cyclists should be excluded by closing the cycle way.

C13.3.4 Signs to be used for temporary paths and detours

Suitable detours and their applicable signs are:

Cycle lane needs to be closed and cyclists are to be directed into the live lane

Cycle Lane Closed sign.

Directional arrows for temporary cycle lanes adjacent to the working space

TU41 to TU46 (TW-32) – Cyclist Direction sign.

C14 Work vehicles, equipment and materials

C14.1 Use of vehicles

C14.1.1 Vehicle movement

Work vehicles must not travel, stop or park:

- against the flow of traffic outside the working space, or
- within the associated safety zones.

Operators should be aware that road users may follow work ~~traffic~~ vehicles into a working space. They must check carefully before reversing or opening doors after entering the working space.

C14.1.2 Loading and unloading

The loading and unloading of materials must be conducted in the working space and not within the associated safety zones or live lanes.

On **level 3** roads vehicles must not stop in live lanes and engage in loading or unloading activities, even with the assistance of TMA. Such activities interfere unnecessarily with traffic flows and create hazards.

C14.1.3 Vehicle-mounted flashing beacons

Work vehicles must have at least one, and preferably two, vehicle mounted flashing beacons that are visible to road users from all directions at all times.

Vehicle-mounted flashing beacons:

- must be switched on prior to a work vehicle entering or leaving a working space
- must be switched off once the vehicle has left the working space
- may be switched off once the work vehicle is within the boundaries of the working space.

Vehicle-mounted flashing beacons must be amber.

C14.1.4 Parking and storage of vehicles, plant and materials

C14.1.4.1 Parking of vehicles, plant and materials

No vehicles, plant or materials are to be left at an unattended site in any of the safety zones including the taper, nor should these items be placed on curves or any similar place where they may be struck by an out-of-control vehicle.

C14.1.4.2 Sites with permanent speed limit under 65km/h

For unattended worksites on roads with a permanent posted speed limit of less than 65km/h which require levels LV, level 1 or level 2 TTM the following applies to the parking of plant:

- where possible (reasonably practicable) all plant must be parked at least 5m outside the edgeline and on the same side of the road as the working space

- where this is not possible plant may be parked in what is normally a parking area subject to the following conditions:
  - the plant must be registered for on road use
  - the plant must be parked on the same side of the road as the working space
  - plant must not be parked on a central median
  - the location where the plant is to be parked must have at least clear sight distance (ie 3 x the posted speed limit in metres) visibility for approaching road users
  - a shoulder closure with advance warning signs, TSL if required by site conditions, a cone taper with an RD6R (RG-34) sign at the head of the taper, cones along the site and parked plant and lateral and longitudinal safety zones must be installed around the parked plant
  - the plant should if possible be parked under street lighting
  - the parking of plant in such situations should be subject to the RCA approval via a signed TMP.

C14.1.4.3 Sites with permanent speed limit over 65km/h

All plant must be parked at least 5m outside the edgeline and on the same side of the road as the working space.

C14.2 Other requirements

C14.2.1 Mud and other debris

The contractor must ensure that all operations do not deposit debris or material on a road surface open to traffic. Any material on the road surface of a worksite should be cleaned off at the earliest opportunity.

C14.2.2 Operating mobile operations within an established static site

Where the mobile operation is contained, completely within an existing fixed static worksite which has, advance warning and direction and protection signs including an approved TSL sign(s) installed, the requirement for a tail pilot vehicle for any subsequent mobile operations is waived.

This dispensation will apply to mobile activities such as:

- sweeping excess chip from a chip seal/reseal site
- road marking a newly sealed road that has been swept.

Note: Apart from the tail pilot dispensation above, all other requirements for mobile operations with respect to shadow and work vehicles must still be applied.

This dispensation must only be applied to sites with a minimum of clear sight distance visibility to the work vehicle at all times during the operation.

C14.2.3 Redundant TTM equipment

Refer to C11.2.8 Redundant TTM equipment for further information about redundant TTM equipment at worksites.

C15 Worksite access

C15.1 Introduction

C15.1.1 General

Vehicles must only enter and exit a closure in the direction of traffic flow. Vehicles are not allowed to stop in a live lane and reverse into a closure, except when the worksite is classified as an emergency and is under the control of emergency services.

Vehicle-mounted flashing beacons must be switched on prior to a work vehicle entering or leaving a closure. Refer to subsection C14.1.3Vehicle-mounted flashing beacons.

TTM must be designed to allow the safe and efficient movement of work vehicles to and from the closure. Maintaining the safety of the site access is the responsibility of the STMS.

C15.1.2 Access and exit points

Except for sealing and paving activit~~work~~ies~~s~~, which are typically moving operations within a larger worksite, clearly defined access and exit points are required for closures on **level 2** and **level 3** roads where the working space is delineated and separate from the live lanes.

Special access and exit points for construction and associated work vehicles may be required if these vehicles have difficulties entering and leaving the closure at the normal access point.

C15.2 Access points

C15.2.1 Signing of access points

The site access must be identified by the TZ1L/R (TW-28) Site Access _m advance warning sign and the TZ2L/R (TW-29) Access Direction sign.

The worksite must meet all other TTM requirements of CoPTTM.

C15.2.2 MTCs at site access points

MTCs may be used on **level LV, level 1** and **level 2** roads to control the flow of vehicles into and out of the closure. MTCs are permitted on **level 3** roads but they cannot slow or stop traffic in live lanes on these roads.

Entry and exit to the closure should be via a clearly signed and delineated site access point.

C15.2.3 Location

The table below details the minimum distances a site access point must be located from any intersection, on- or off-ramp, taper, or obstruction that could restrict visibility.

Where necessary, multiple access/exit points may be provided. However, the location of these should always be in accordance with the provisions of CoPTTM.

The provision of the appropriate acceleration and deceleration areas either side of a site access is desirable, particularly in high-speed situations. Site accesses should not normally be placed on curves.

Location of site access

*Permanent/temporary speed limit	50km/h	60km/h	70km/h	80km/h	100km/h
Minimum distance between a site access and any intersection, on- or off-ramp, taper or obstruction.	50m	60m	70m	80m	100m

* C2 Worksite layout details where TSLs are used to set up worksite layouts.

C15.2.4 Delineation of site access

The site access opening must be identified with delineators spaced 2.5m for:

Level 2 and 3 roads	20m either side of the opening

C15.2.5 Removal of delineation devices to provide site access

To allow work vehicles to gain access to a closure, delineating devices may need to be removed.

These devices must be replaced immediately to ensure other road users do not enter the closure. Delineation devices must be placed according to the appropriate layout distance table in section C2 Worksite layout.

C16 Managing traffic queues

C16.1 Introduction

C16.1.1 General

Activities on a road often disrupt traffic and result in delays to road users. Road users should be disrupted or delayed as little as possible and delays must be kept to a minimum.

Note: Each RCA can set the timeframe acceptable for delays on their network. Many RCAs set a maximum timeframe of five minutes for delays to traffic.

C16.2 Queuing and delays

C16.2.1 Queuing

Rear end crashes are a major concern at worksites. Approximately 20 percent of crashes at worksites are queuing related crashes.

The STMS/TC is responsible for monitoring the queue length. On roads with a permanent speed limit greater than 50km/h it is important to ensure that the first advance warning sign is always located where an approaching road user can see the sign beyond the end of the maximum queue.

This can be a problem on one-way multilane divided roads through a worksite and where the road alignment has significant vertical and/or horizontal curvature.

In these circumstances the advance warning and direction and protection signs may need to be located further in advance of the worksite and in a position that they are clearly visible to all road users approaching the end of the queue.

Additional reminder signs may need to be erected closer to the closure when queues and/or visibility restrictions are excessive.

Refer to subsection C3.3.2 Positioning of signs for information about placement of advance warning signs.

C16.2.2 Delays

TMPs must address any delays anticipated by worksite activities, including simple calculations to determine if delays of more than the maximum time allowed by the RCA are likely (normally five minutes). The contractor/TMP applicant must supply this information for **level 2** and **level 3** roads.

The RCA must be informed if delays of more than the maximum time limit are likely. The RCA is responsible for verifying the calculations and determining, in negotiation with the contractor/TMP applicant, the appropriate action, eg allow the predicted delays to be imposed, restrict ~~work~~ hours of activity, periodically pause activity~~work~~ to allow queues to disperse.

Where substantial queuing is expected, and alternative routes are available, consideration should be given to the use of those routes.

C16.2.3 Delay

From time to time, delay calculations may be required by the RCA.

calculations

C16.2.4 Capacity

The maximum traffic capacity through a worksite should be provided with due consideration of safety. Delays are unavoidable at times.

Simple delay calculations can be done for closing one lane on **a two-way two-lane** road on the assumption that delays of more than five minutes occur when the following thresholds are exceeded:

- if a lane more than 200m from an intersection carries more than 1000vph, and
- if a lane within 200m of an intersection carries more than 500vph.

Delays can be assessed as follows:

1. Find the peak hourly traffic volume for each lane past the closure. (If the peak hourly traffic volume per lane is not known it can be estimated using half the AADT divided by 8).
2. Add the peak hourly traffic volume for both lanes.
3. If the total is greater than 500vph and the worksite is within 200m of an intersection then five minute delays are expected.
4. If the total is greater than 1000vph and the worksite is further than 200m from an intersection then five minute delays are expected.
5. If the thresholds in (3) or (4) are not exceeded then delays in excess of five minutes are not expected.

These traffic volume thresholds may need to be reduced if:

- the road is rough or unsealed
- the horizontal geometry restricts speeds to less than 40km/h, or
- the proportion of heavy vehicles exceeds 12 percent.

The information required for these calculations must be supplied to the contractor by the RCA.

The delay calculation method described above is only applicable to two-way two-lane roads. Other types of road require more elaborate queuing and delay calculations.

Guideline capacities in the table below indicate when delays can be expected.

Guideline capacities

Road type	Single lane flow	Two-lane to one-lane merge on a one-way carriageway (ie one direction on a divided carriageway road)	Two-way flow on a one-lane section of road (based on a 500m closure and a two to five minute signal cycle)
Interrupted traffic flows and queuing is likely to occur at about	1500vph	1300vph	600-800vph (two-way)

C16.2.5 Examples of simple delay calculations

Example 1

One lane is to be closed on a two-lane two-way road. The lane closure is within 200m of an intersection. The estimated traffic volumes (provided by RCA) for the planned activity~~work~~ times are 300vph (southbound) and 250vph (northbound).

The total traffic volume required to use one lane is 550vph (300 + 250) and this traffic volume is greater than 500vph, ie the threshold for lanes within 200m of an intersection.

From this information the contractor would decide that delays of more than five minutes were reasonably expected because the 500vph threshold is exceeded.

Example 2

One lane is to be closed on a two-lane one-way road. The peak hourly traffic volumes are unknown but the AADT is 6000. The lane closure is not within 200m of an intersection.

Peak hourly traffic per lane is 6000/2 = 3000/8 = 375vph.

The sum for the 2 lanes is 750vph (375 +375).

Delays of more than five minutes are not unreasonable while the activity~~work~~ is in progress because the threshold of 1000vph for lanes more than 200m from an intersection is not likely to be exceeded.

C17 Light arrow system (LAS), horizontal arrow board, truck-mounted attenuator (TMA) and variable message sign (VMS)

C17.1.1 Requirements

The light arrow system (LAS) and horizontal arrow board are primarily used for mobile operations, but they may also be used for static operations where additional safety is required.

The LAS is only to be used on level 2 and level 3 roads to ensure the uniqueness of the system for the higher volume roads.

The horizontal arrow board may be used on non-state highway level 2 roads and also on level LV and level 1 roads.

LAS or horizontal arrow boards must not be used to direct traffic in alternating flow situations.

C17.1.2 Location

Arrow boards for static operations must be positioned in the centre of the closed lane and longitudinal and lateral safety zones must be provided in advance of the arrow board and between the arrow board and live traffic lane respectively.

C17.1.3 Operating instructions for arrow boards

When operating LAS or horizontal arrow board on a static site, use the permitted displays detailed in subsection D1.7.1 LAS requirements and subsection D1.8.3 Permitted display for horizontal arrow board.

C17.1.4 Use of TMAs

TMAs must be used in accordance with the manufacturer's recommendations and the NZ Transport Agency's standards.

While TMAs are primarily used for mobile and semi-static operations they can also be useful in some high-risk static operations.

For static operations TMAs:

- are generally only considered for sites occupied by personnel or objects that will present a hazard to road users, and
- are generally only justified on **level 2** and **level 3** roads for lane closures.

They may also be used for working spaces on the shoulder to increase road worker and road user safety.

C17.1.5 Location of TMA

Work vehicles are often used to shield personnel from passing traffic. However, if a vehicle crashes into the back of the vehicle serious injuries can result, especially at high approach speeds.

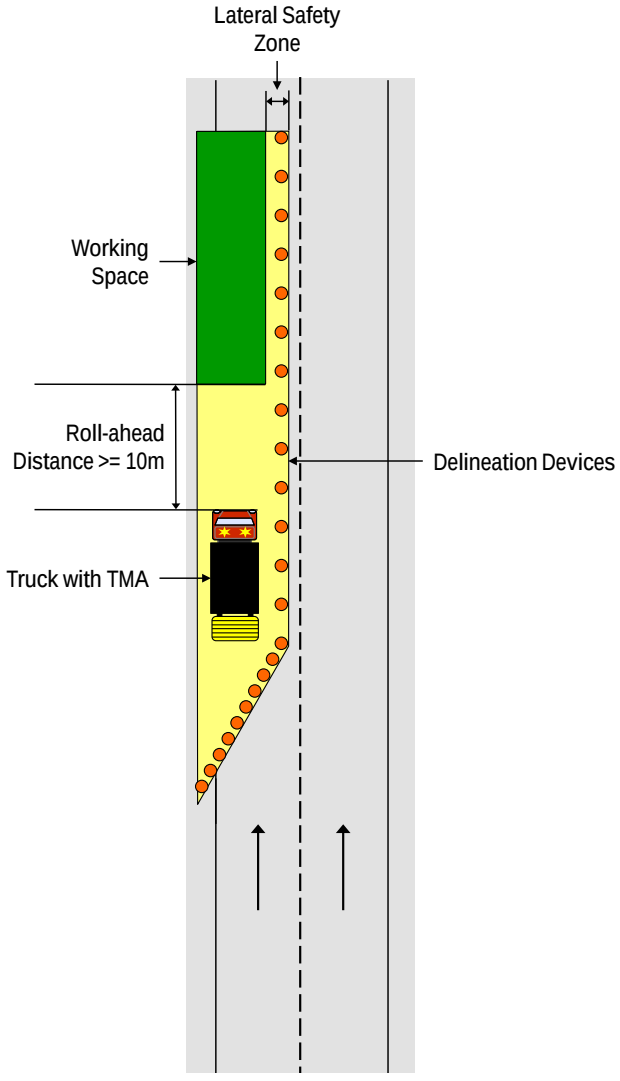
When a TMA is impacted it is possible that the truck will roll forward. This roll-ahead distance is dependent on many factors including:

- angle of impact
- weight of the vehicle impacting the TMA
- weight of the vehicle mounted with the TMA
- pavement conditions
- brake engagement.

There must be a clear distance of at least 10m in front of a truck mounted with an attenuator to allow the truck to safely move forward if impacted by a light vehicle travelling at a speed of less than 100km/h.

This space must be kept clear of personnel and equipment.

The longitudinal and lateral safety zones must be provided in advance of the TMA and between the TMA and live traffic lane respectively.



C17.1.6 Operating instructions for TMA

When operating a TMA on a static site, the requirements of subsection D1.10 Truck-mounted attenuator (TMA) must be met.

C17.1.7 Variable message signs

Variable message signs are optional devices that can be used to highlight specific hazardous situations (eg where visibility is restricted or where additional useful messages need to be shown to road users).

They are an additional form of traffic management and must not be used to replace the normal signs and/or devices used for TTM.

Details of acceptable equipment are given in section B10 Mobile variable message signs (VMS).

With the RCA's approval, permanently installed Automatic Traffic Management Systems (ATMS) signs may be utilised to advise road users of worksite operations or specific hazards on the road ahead, and to guide traffic around those operations or hazards.

Variable message signs must be used as per the NZ Transport Agency's P37 *Specifications for mobile variable message signs* (in press).

C18 Temporary road safety barrier systems

C18.1 Introduction

C18.1.1 General

Temporary road safety barrier systems are designed to provide protection through a physical separation between traffic and an adjacent area. Their purpose is to redirect an impacting vehicle and minimise occupant injury, while providing protection to those people and/or the protected area behind the barrier.

Temporary road safety barrier systems can be used:

- where a working space must be shielded from adjacent traffic, or
- when the traffic must be shielded from worksite hazards (eg deep excavations), or
- when there are no other options to safely channel vehicle and pedestrian movements.

Generally, road safety barriers should only be used for physical protection and to reduce the severity of potential crashes, as they are a significant hazard themselves. It is preferable that traffic be safely channelled through or around a worksite without the use of barriers.

C18.1.2 Considerations that influence whether barrier should be used

The following considerations influence whether a longitudinal barrier should be used for protection:

- Traffic volume

  Generally only level 2 and level 3 roads will justify the installation of barriers. Their use may improve productivity through physical separation, and reduce traffic delays through avoiding more restrictive temporary speeds. Barrier systems may be considered for longer-term worksites on level LV and level 1 roads.

- Traffic speed

  Generally barriers are only justified on roads with speed limits greater than 65km/h. However, barrier protection for pedestrians may be justified at lower speeds (eg when a temporary footpath makes use of a road shoulder).

- Worksites restrictions

  Generally barrier protection may be justified where there is insufficient width to provide an adequate lateral separation between the protected area and adjacent traffic. However, the deflection of the barrier system must be accommodated in the area immediately behind the barrier.

- Duration

  Generally only a longer-term operation will justify the installation of barriers. As a rule of thumb the duration is usually more than one day on level 2 and level 3 roads.

C18.2 Barrier hardware selection considerations

C18.2.1 General

Road safety barrier performance levels used in New Zealand are based on the United States National Cooperative Highway Research Program (NCHRP) 350 performance regime.

The design, selection and installation of a road safety barrier system must reflect the critical vehicle mass, impact speed, and angle of impact. Each of the input variables contributes to the impact energy and the consequent barrier performance.

For example a significant presence of heavy vehicles, higher speeds, or steeper angles of impact (eg on the outside of curve) will require higher performing road safety barrier systems. Lower performing barrier systems may be appropriate where there are fewer heavy vehicles in traffic, speeds are managed to lower levels and where traffic is travelling parallel and close to the barrier to minimize impact angles.

Barrier system performance test levels related to the adjacent operating speed are summarized in the table below.

Barrier system performance levels

Test level	Operating speed
1	50km/h or less
2	50km/h to 70km/h
3	greater than 70km/h

Typically these performance test levels are based on the crash performance of a 2000kg vehicle hitting the barrier at an angle of 25 degrees, at the respective operating speeds.

The correct design, hardware selection and installation will limit the potential penetration of the protected area by an out of control vehicle.

The selected system or component must have complied with a test level that meets or exceeds the operating speed of adjacent traffic. The speed value used to determine the required barrier performance level must be the highest likely impact speed.

For example if an unattended worksite is left with the barrier in place and the temporary speed restriction removed or not enforced, the required performance level must be for the higher permanent speed.

The options are to ensure that speeds can either be managed to that for the lower barrier performance level at all times, or to select a higher barrier performance level.

The higher barrier performance level will also provide increased protection for the area behind the barrier, from errant vehicles that are heavier, faster or impacting at an angle steeper than 25 degrees.

All barrier systems must be installed in accordance with the manufacturer's or supplier's installation guidelines. Failure to do so can result in the failure of the system through unconstrained deflection of the barrier into the protected area, differential movement of the units causing snagging and pocketing hazards, or the rupture of the system and the entry of an errant vehicle into the protected area.

Freestanding units will either slide or roll into the protected area posing a hazard to workers, pedestrians or adjacent traffic.

Different types of barriers cannot be joined together without an approved transition. The mixing of different barrier types with variable deflection and cross-section characteristics will lead to unpredictable crash containment outcomes.

C18.2.2 Water filled plastic barriers

Crash impact energy is managed through the plastic sections being filled and ballasted with water and being properly jointed and anchored.

The plastic barrier sections must be jointed by the approved system over the minimum length specified by the manufacturer or supplier for the system to perform adequately.

Test results have shown that the deflection of some types of water filled plastic barrier systems can be substantial.

Modular plastic barrier sections are light and easily transportable and installed when empty.

Water levels in the plastic units must be monitored and refilled to maintain the design performance level. Water leaking from a unit can also cause slippery conditions and potentially loss of control crashes. Faulty units should be repaired or replaced as soon as possible.

C18.2.3 Concrete barriers

Concrete barriers are appropriate at locations where deflections must be limited.

Transportable concrete barriers may only be considered to be a rigid barrier system with zero deflection when the sections are jointed by an approved system and keyed or pinned to the road surface, to prevent any lateral movement under impact.

If an installation does not meet these requirements it will be considered to be semi-rigid system. The resulting deflection must be accommodated in the design of the working space or protected area.

The minimum length of barrier must be installed for the system to perform adequately.

C18.2.4 Steel barriers

Transportable steel barriers sections are similar in cross section to concrete barriers, but are about 10 percent of their weight. Anchors are required at the end of each run.

All transportable steel sections must be installed in accordance with the manufacturer's and supplier's installation guidelines.

C18.3 Lateral placement

C18.3.1 Barrier system placement

Increasing the distance between a barrier and the traffic lane:

- reduces drivers' shy line reaction to the barrier
- increases the space available for vehicles to regain control before impacting the barrier
- increases sight distances, and
- reduces the length of barrier required to shield a particular hazard.

Barrier system placement is a trade-off between having barriers as far from the traffic lanes as conditions permit, while ensuring that there is adequate room behind the barrier to accommodate its dynamic deflection under impact.

The barrier designer and worksite management personnel must consider the orientation of the barrier relative to the speed and approach angle when considering barrier selection options and placement.

Barrier systems are designed to deflect on impact and sufficient space for this to occur must be provided behind the barrier. The distance between the working space occupied by personnel or the protected area and the barrier must be sufficient for the likely dynamic deflection of the barrier to occur. This area must be kept clear of material and equipment to enable the deflection and containment to occur.

C18.3.2 Deflection space

The amount of deflection space required is dependent on the type of barrier system being used. Rigid, semi-rigid and flexible systems vary greatly in their expected deflection upon impact.

Typically a semi-rigid concrete system will deflect up to 2.5m for a TL-3 impact. A water filled system will deflect up to 4m for a TL-2 impact and 6.9m for a TL-3 impact.

Recommended design deflections for specific temporary road safety barrier systems are available from the manufacturers or suppliers.

Given the high deflections of some water filled barrier systems they may not be an appropriate choice in a high speed application, or where the barrier is likely to be struck at a high impact angle, or when there is limited room behind the barrier to accommodate deflection without compromising the protected area or working space.

In situations where a working space is protected by a permanent road safety barrier system, sufficient space to accommodate deflection must also be provided.

The design deflection for most permanent road safety barrier systems can be found in the *NZTA M23:2009 Specification for road safety barrier systems* appendix A.

Details for temporary barriers can be found in *NZTA M23:2009 Specification for road safety barrier systems* appendix B.

C18.3.3 Shy line

Drivers tend to shy away from objects placed close to the edgeline of the road. Obstacles located within this shy line distance will affect driver behaviour and tracking. The table below presents the shy line offsets for various TSLs used at worksites.

Shy line offsets

~~Operating~~ Temporary speed (km)**	50	60	70	80	100
Barrier offset to edgeline (m)	1.0	1.0	1.0	1.0	2.0

*** Use the permanent speed limit in cases where a temporary speed limit is not applied*.

It is preferable that the barrier or end treatment be placed outside of the Shy line distance to avoid this potentially dangerous driver behaviour. Distances greater than those given in the table above should be provided wherever possible.

The additional space provides additional recovery area for errant vehicles, and will improve driver sight distance on curvilinear alignments. On worksites where space is severely limited, smaller shy line offsets may be requested in the TMP.

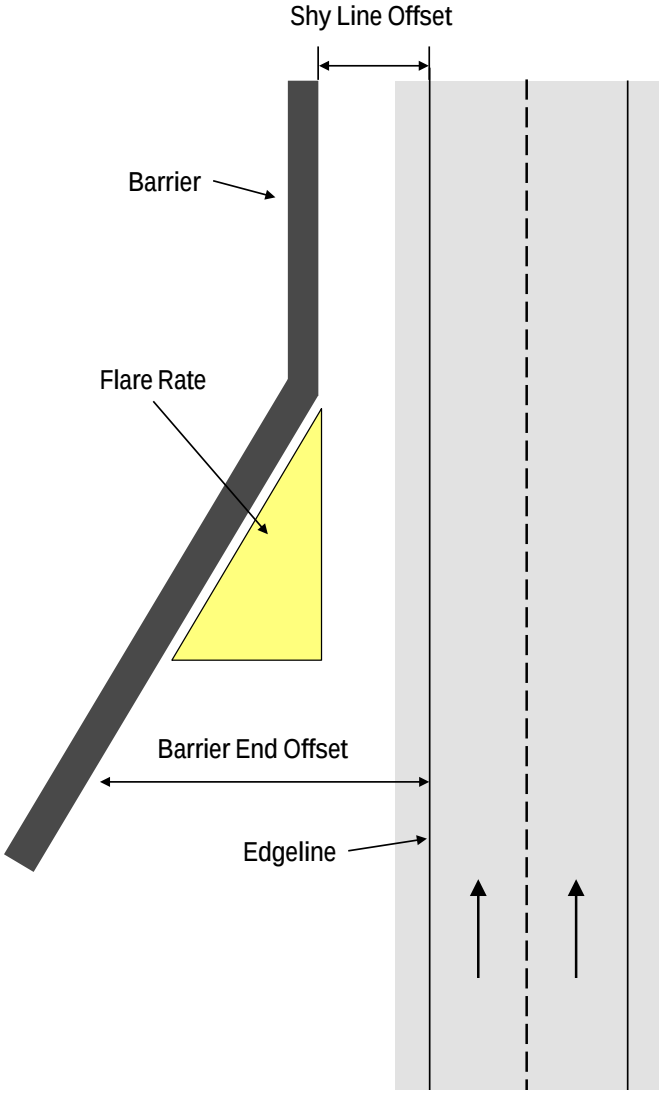
However, the absolute minimum offset in all situations must be 300mm from the edgeline.

Barriers placed close to the edgeline will suffer from more nuisance hits and require more maintenance. Barrier systems should not be installed more than 4m from the edgeline to decrease the potential impact angles.

All barrier systems must be installed, such that there is a continuous smooth surface, to reduce the possibility of a vehicle snagging on impact.

Barriers must not be placed where they will restrict sight distance for vehicles entering, exiting, crossing or moving through the worksite.

Offset and flare reference locations



C18.4 End treatments

C18.4.1 General

The principles and best practice for permanent road safety barrier system design, selection and installation also apply to temporary installations. If a barrier system is required for a protected area or working space it must provide adequate shielding to ensure that an errant vehicle cannot enter the area.

All unprotected barrier ends pose a significant hazard to vehicles. The options are to:

- provide an approved end treatment
- flare the barrier system away from the road such that the end cannot be hit, or
- connect the barrier onto or start the barrier line behind the trailing end of a permanent barrier/guardrail system.

Unprotected barrier ends require an approved end terminal if they are located within the minimum offset distance measured from the edgeline, as shown in the offset and flare reference locations diagram on the previous page. The table below summarises these requirements.

Minimum barrier end offsets

Operating speed (km/h)	50	60	70	80	100
Distance between unprotected barrier end and edgeline (m)	3	4	6	8	9

Where the end of a barrier can be impacted by an errant vehicle it must be protected by an approved end treatment and transition that is securely attached to the barrier. These are generally temporary plastic water filled crash cushions, or permanent type crash cushions used in longer term worksites.

Approved temporary end treatments are listed in section B12 Barrier systems. Approved permanent end treatments listed in the *NZTA M23:2009 Specification for road safety barrier systems* appendix A may be used in temporary applications.

End treatments must be installed and be immediately operational as part of the installation of the barrier system.

Temporary end terminals will generally be gating systems. If a gating end treatment is used, a 22.5m long X 6m wide clear zone on a maximum slope of 1:10 must be provided behind the end treatment to allow the gating to occur.

The manufacturer and supplier will provide the necessary installation information.

C18.4.2 Flares

Flares are used to locate the end of a barrier further away from a traffic lane, as shown in the offset and flare reference locations diagram.

A barrier end installed on a flare at a location where it cannot be hit by an errant vehicle will not require an end treatment. However, if the area in the front of a barrier end is traversable it must be protected.

Generally, a barrier system should be installed to minimise the angle of impact to reduce the crash impact energy. This will reduce the impact severity and the dynamic deflection into the working space or protected area.

Applicable barrier flare rates must not be exceeded such that the flared barrier is hit at a steep angle. A barrier impact angle in excess of 25 degrees exceeds the tested performance level.

Recommended flare rates for barrier system types are given in the table below.

Recommended flare rates

Operating speed	50km/h	60km/h	70km/h	80km/h	100km/h
Barrier inside shy line	1:18	1:18	1:21	1:24	1:30
Rigid barrier outside shy line	1:12	1:12	1:14	1:16	1:20
Non-rigid barrier outside shy line	1:10	1:10	1:11	1:12	1:15

Lower flare rates that are provided by the manufacturer or supplier of a system must govern over these values.

C18.5 Barrier length

C18.5.1 Length of need

The barrier length requirement assures that a sufficient length of barrier is installed to prevent a vehicle leaving the road and entering the working space or protected area. Out of control vehicles typically leave the road at angles of less than 25 degrees and may travel considerable distance before impacting a hazard.

The length of need is the length of approach barrier needed to shield an errant vehicle from passing behind the barrier and entering the working space or protected area.

Factors influencing the length of need include:

- the length and width of the area personnel are occupying or the hazard to be protected
- the probable path and stopping distance for a vehicle leaving the roadway to avoid hitting objects in the protected area
- the layout of the barrier, including its lateral placement
- the location of the start of the flare (if any) and its flare rate, and
- the minimum length of barrier for the barrier to develop its ribbon strength.

The length of need may be determined using the simplified angle of departure method. The typical angles of departure for vehicles leaving the road are summarised in the table below.

Angles of departure

Operating speed (km/h)	Leading angle (a) (Ratio 1: Forward distance)	Trailing angle (b) (Ratio 1: Forward distance)
less than 75	6° (1:10)	22° (1:2.5)
75 to 95	4° (1:15)	22° (1:2.5)
greater than 95	3° (1:20)	22° (1:2.5)

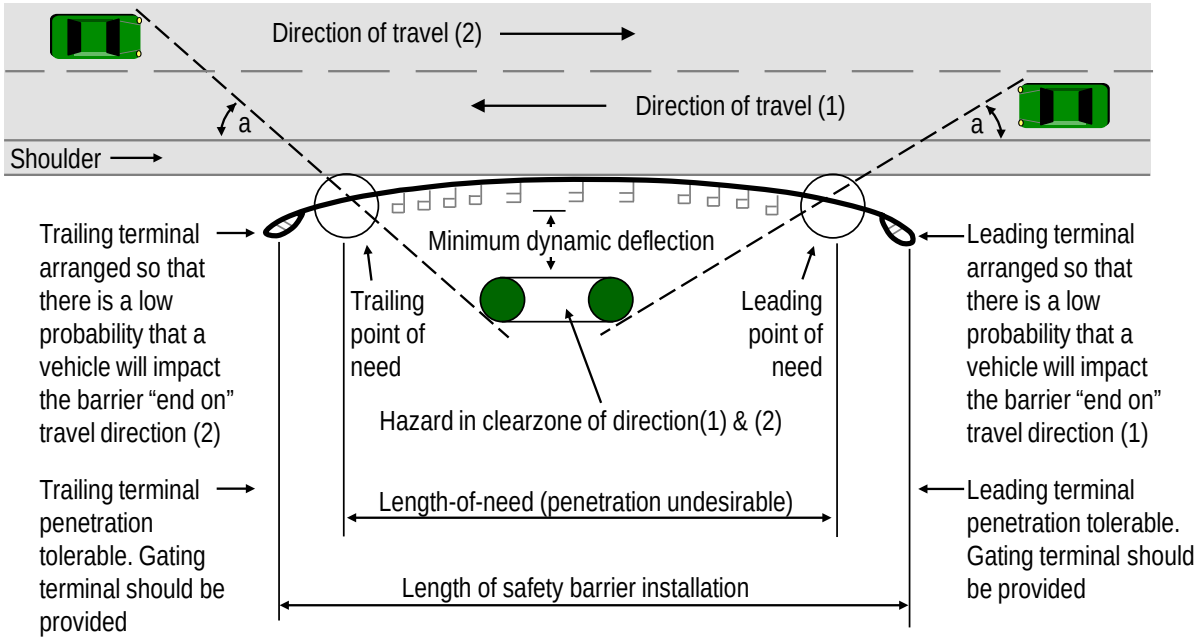
The graphical angle of departure method is summarized in the figure on the page.

The leading and trailing angles should be measured from a tangent on the outside lane edgeline.

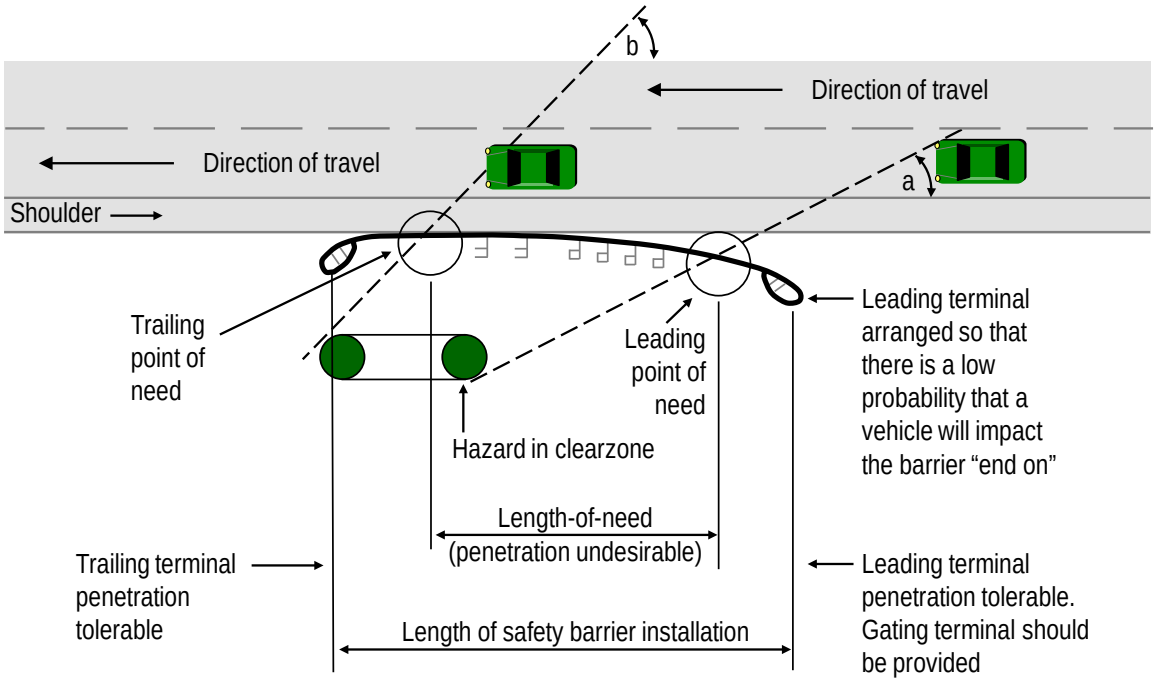
On the inside of a horizontal curve on a one-way carriageway the leading point of the length of need is established from a chord at the back of the hazard perpendicular to the centre of the curve.

The trailing point of the length of need is established using the trailing angle of departure. On a two-way carriageway the leading and trailing ends are established by the intersection of the long chord with the lane edgeline.

Length of need - tangents



(a) Two-lane two-way road



(b) Wide multi-lane carriageway or one-way carriageway

C18.5.2 Minimum length

The length of need for barrier must be longer than the hazard itself.

The minimum length of a barrier system exclusive of end treatments will be the greater of the length of need or the minimum length for a particular system to perform as tested.

The minimum length for proprietary systems will be available from the manufacturer or supplier.

A user must ensure they understand the distinction between the minimum system length for containment, and the additional length for end treatments.

C18.6 Ground shape

Barrier systems are designed for impacts by vehicles with all four wheels on the ground and the suspension components in their normal position. The ground between the traffic lane and the barrier should therefore, be as level as possible, but no greater than the adjacent lane cross fall.

Any kerb(s) between the barrier and the traffic lane should be removed where the distance to the face of the kerb is greater than:

- 1.5m where the speed is 60km/h or less
- 2.1m where the speed is 70km/h, and
- 2.7m where the speed is 80km/h or more.

Barrier systems should not be installed on embankments with slopes steeper than 1:6, and preferably not steeper than 1:10.

All temporary barrier installations must allow surface drainage to pass unimpeded, to avoid surface ponding.

C18.7 Delineation

Temporary barrier systems should be conspicuous and have adequate delineation installed.

At night or during inclement weather this will improve the driver's ability to see the barrier and be guided past the protected area or working space. Maintenance and cleaning of the delineation and barrier face will enhance safety.

Barrier systems must not be the primary type of delineation for tapers, except on roads with permanent speed limits of 65km/h or less.

Where barrier systems are used on roads with permanent speed limits higher than 65km/h the primary means of delineation must be chevrons and road marking or cones placed on the traffic side of the barrier.

When the barrier is removed the temporary road markings must be removed by water blasting, or another removal technique approved by the engineer.

Section B12 Barrier systems provides the recommended delineation layout.

When barriers are installed complete with delineation chevrons at 10m centres and with temporary road markings in place the need to also install cones for delineation is removed.

C18.8 Approval requirements

Barrier system installation issues that are not covered by the manufacturer's or supplier's guidelines must be referred to the supplier for resolution. These referrals and outcomes must be documented. Any outstanding issues should be referred to the NZ Transport Agency's National Traffic and Safety Manager for resolution.

The TMP must include a copy of the approved current barrier placement plan and the completed product specific installation checklists. The documented installation issue resolutions must also be included. A copy of the applicable product specific installation guidelines must also be kept at the worksite.

Any barrier placement changes done in the course of activity~~work~~ must be reflected in the approved current barrier worksite plan and checklists.

A temporary road safety barrier system must be monitored to ensure that the placement and condition remains acceptable. Any modification in the course of the activity ~~work~~ requires that the modified system still comply with length of need, deflection, and the manufacturer's or supplier's installation guidelines.

C19 Maintenance standards

C19.1 General

The normal use of TTM equipment subjects it to wear and tear that does not occur with permanently installed equipment or devices.

Much of this wear and tear occurs during the storage, travel, installation, relocation and removal phases of TTM and causes deterioration in the appearance and effectiveness of the equipment and devices.

Whenever a high number of these worn and damaged devices are installed on a worksite the general appearance of the worksite deteriorates, reducing the level of safety for both road workers and road users.

C19.2 Quality classifications and requirements

The quality of TTM devices is divided into three categories: **acceptable**, **marginal** and **unacceptable**.

At the **time of the initial installation**, or at the time of any major changes to the ~~work~~ worksite, **100 percent** of each type of device must be in an **acceptable** condition.

Types of devices include cones, tubular markers, barrels, barricades, barrier delineators, barriers, fence delineators, signs, variable message signs, arrow boards, temporary pavement markings, raised pavement markings and high-visibility clothing.

Equipment that must be in an **acceptable** condition at all times are:

- delineation devices at changes in direction including cone tapers, lateral lane shifts and chicanes
- T1'_' (TW-1.'_'), T2'_' (TW-2.'_'), TR1L/R (TW-3), TR2'_' (TW-4.'_'), TR3'_' (TW-5.'_'), RS1 (RG-1), RS2 (RG-2), RS3 (RG-2.1), TG1 (RG-4) and TA2'_' (TW-15'_') signs
- high-visibility safety garments.

Up to 25 percent of other equipment and devices may be in a **marginal** condition.

Once more than 25% of devices at a worksite are identified as being in a **marginal** condition the equipment and devices must be cleaned to an **acceptable** standard, or replaced with **acceptable** equipment and devices within 12 hours.

Equipment and devices that are identified as being in an **unacceptable** condition are not permitted on the worksite and must be replaced immediately.

C19.2.1 Acceptable classification

Devices that meet the quality requirements as described in subsection C19.2 Quality classifications and requirements for this classification, and all other requirements such as design, size, colour, weight in the plans and specifications, must be considered to be acceptable for use as a traffic management device at worksites.

C19.2.2 Marginal classification

The term 'marginal' means marginally acceptable or at the lower end of acceptability. Devices that meet the quality criteria for marginal as described in subsection C19.2 Quality classifications and requirements for this classification, may remain on the worksite until 25 percent of the devices on the worksite are classified as marginal, or until it is determined that they have become unacceptable. When devices in the marginal category reach 25 percent those devices must be cleaned or replaced to the acceptable standard within 12 hours.

C19.2.3 Unacceptable classification

Devices in this category must not be delivered to the worksite. When found at a worksite, they must be replaced or repaired immediately.

C19.3 Evaluation for classification of TTM devices

C19.3.1 Evaluation guide: Traffic signs

Acceptable

A sign is acceptable if:

- there are abrasions on the surface but very little on the lettering or symbol
- there has been no touch-up of the lettering or symbol
- the message is legible and matches the approved design as per section B1 Signs.

Marginal

A sign is marginal if:

- there are many surface abrasions throughout the sign face and many are within the individual letters or symbol of the message
- the surface is marked by material (such as asphalt, bitumen, cement slurry or dirt) not obscuring the lettering or symbol
- some colour fading is evident, the background colour and reflectivity are still apparent
- the message is legible and matches the approved design as per section B1 Signs.

Unacceptable

A sign is unacceptable if:

- there is material (such as asphalt splattering, bitumen, cement slurry or dirt) obscuring the lettering or symbol
- the symbol and/or some letters have a loss of more than 50%
- there is a significant colour fading
- the message is illegible and does not match the approved design as per section B1 Signs.

C19.3.2 Examples of sign quality

	Daytime	Night-time
Acceptable		
Marginal		
Unacceptable		

C19.3.3 Evaluation guide: Sign stands and/or supports

The stands and/or supports upon which signs are mounted are evaluated in terms of their:

- stability
- effectiveness in holding sign panels, and
- potential for damaging sign panel faces or injuring workers while being handled or transported.

Acceptable

Stands and/or supports should be evaluated as being in acceptable condition if they:

- have minor buckling or bending but are still able to stand upright.

Marginal

Stands and/or supports should be evaluated as being in marginal condition if they:

- are buckled or bent such that the sign panel cannot be correctly connected to the stand and/or support
- allow panels to be deformed by wind or other loading
- allow round panels to be rotated within their frame.

Unacceptable

Stands and/or supports must be evaluated as being in unacceptable condition if they:

- have hanging weights of any type attached to the frame
- have bases that will roll
- are non-frangible
- unable to be placed/disassembled to a height equal to or less than 150mm
- are not able to hold the sign in a stable upright position (eg stand has buckled, stand has uneven legs and rocks from side to side).

C19.3.4 Evaluation guide: Cones and tubular delineators

Acceptable

A cone is acceptable if:

- the shape of the delineation device remains clearly identifiable with no significant distortion and is free standing in its normal position
- the surface is free of punctures and abrasions
- the surface is free of material (such as asphalt, cement slurry or other material) and will readily clean-up by washing
- the reflective bands have little or no loss of reflectivity with only minor tears and scratches.

Marginal

A cone is marginal if:

- the surface is marked by material (such as asphalt, bitumen, cement slurry or dirt) and cannot be readily cleaned
- the reflective bands have numerous tears and scratches
- the reflective bands are largely free of residue.

Unacceptable

A cone is unacceptable if:

- punctures and large areas of staining (due to materials such as asphalt, bitumen, cement slurry or dirt) make the device an unlikely candidate for improvement
- there is a significant area of missing or stained reflective material.

C19.3.5 Examples of cone quality

	Daytime	Night-time
Acceptable		
Marginal		
Unacceptable		

C19.3.6 Evaluation guide: High-visibility garments

Section B3 High-visibility garments details the design requirements for high-visibility clothing.

All high-visibility garments must be:

- in acceptable condition, and
- done up at all times when working on the road.

The quality is assessed for suitability for both daytime and night-time use of the high-visibility garment.

Acceptable

A high-visibility garment is acceptable if:

- the garment has only minor tears and scratches
- any abrasions do not seriously reduce the reflectivity or daytime impact.

Marginal

A high-visibility garment is marginal if:

- the garment has numerous tears and scratches
- the garment has some marks (from materials such as asphalt splattering, bitumen, dirt or cement slurry) and may not be readily cleaned due to abrasion or discoloration. However, it is free of large areas of residue or missing reflective material.

Unacceptable

A high-visibility garment is unacceptable if:

- there are large areas of missing reflective material or asphalt splatter, bitumen, dirt or cement slurry
- there is missing and/or covered reflective material
- the garment is **not** done up.

  Jackets that are undone reduce the target value and are classified as unacceptable.

C19.3.7 Examples of high-visibility garment quality

	Daytime	Night-time
Acceptable		
Marginal		
Unacceptable		

C19.4 Personal safety

C19.4.1 Personal protective equipment (PPE)

PPE is essential for the safety of workers on site.

Wearing a high-visibility garment is a critical element of personal safety.

Other PPE that may be required includes (but is not limited to):

- hard hats
- reinforced toe cap boots
- ear muffs
- lanterns
- wet weather clothing.

C19.4.2 High-visibility garments

All high-visibility garments must meet the requirements of section B3 High-visibility garments.

Everyone on the worksite must wear a high-visibility garment. This garment must be put on before entering the worksite.

High-visibility garments must **always** be done up when being worn on a worksite.

The high-visibility garment must be the outer layer of clothing (eg not covered by a non-compliant rain coat in bad weather).

C19.4.3 STMS garment

The STMS on all level 2 and level 3 roads must wear the STMS garment.

The STMS garment must also be worn by an STMS on level LV and level 1 roads where there are three or more, personnel on the worksite.

Where there are less than three personnel on the worksite, the level 1 STMS may wear a standard garment.

The STMS garment is not worn by a site traffic management supervisor – non-practising (STMS-NP). When on the worksite they wear a standard high-visibility garment.

C19.5 Maintenance of traffic management measures

C19.5.1 Monitoring frequency for TTM measures

Monitoring frequency is included in the approved TMP. The frequency will depend on individual worksite conditions and traffic volumes.

Crashes or near crashes, skid marks, traffic queues, unusually high or low speeds are indicators that traffic management measures may need to be reviewed.

If actions are required every time traffic management measures are monitored, then the monitoring frequency should be increased.

Minimum inspection frequency for traffic management devices such as portable traffic signals at unattended worksites should be worksite specific and stated in the TMP.

The maintenance measures contained in this section are mandatory for **level 2** and **level 3** roads and recommended for **level** LV and level **1** roads.

Checklists derived from the contractor's quality plan should be provided in advance and completed following each inspection.

The contractor must ensure that:

- all traffic management devices function properly for the full duration of their installation
- the visibility and effectiveness of all devices and signs is maintained
- damaged equipment is repaired or replaced, as appropriate, and
- suitable equipment should be available at short notice in case of un-programmed removal, alteration or installation of a closure is necessary.

At attended worksites the STMS/TC must carry out the checks listed below.

Minimum Inspection frequency for traffic management devices

Device	Minimum inspection frequency
Sign: position and cleanliness	Two (2) hourly
Portable channelling and delineation devices: position and cleanliness	Two (2) hourly
Flashing beacons on vehicles	Daily
Wearing of safety jackets	Continuously
Safety jacket cleanliness	Daily
Arrow board operation in mobile closures	Prior to start of ~~work~~ operation and 2 hourly thereafter
Arrow board operation in static closures	Two (2) hourly
Non-portable equipment	Daily

The first inspection should take place as soon as the equipment has been installed. This should verify that all devices are correctly in place, no item has been omitted, all equipment meets its cleanliness requirements and no conflicting messages exist between permanent signs, temporary signs and other devices.

To facilitate worksite maintenance adequate stockpiles of equipment should be available, to ensure that response times can be achieved.

C19.5.2 Proprietary barrier and impact-absorbing systems

Where the surfaces of these devices are intended to aid delineation, because of their colour, they must be kept clean and be to at least the acceptable standard defined in subsection C19.3.4 Evaluation guide: Cones and tubular delineators.

The following must be inspected immediately after installation, every alternate working day and immediately after any involvement in a traffic crash.

- alignment
- barrier continuity
- linkage systems
- tensioning systems
- ballast fill levels
- ballast leakage
- damage due to impacts or wear and tear
- condition of frangible or crushable components, and
- cracked barriers (these are to be replaced).

Repairs and adjustments must be made to alignment faults greater than 30mm within one hour of occurrence, or within one hour of inspection, whichever allows the earliest remedial repairs to be undertaken. Other faults must be rectified within one working day.